LPOD

Outdoor Amplifier / Block Up Converter (BUC)
Installation and Operation Manual

LPOD

Outdoor Amplifier / Block Up Converter (BUC)
Installation and Operation Manual

Part Number MN-LPOD
Revision 10

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PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data LPOD family of Outdoor Amplifiers / Block Up Converter (BUCs). This document is intended for the persons responsible for the operation and maintenance of the LPOD PS 1, PS 1.5, or PS 2.

Related Documents

- **Comtech EF Data CLC-10 Handheld Terminal M&C Accessory for LPOD or SPOD PS 1, PS 1.5, PS 2 User's Guide (CEFD P/N MN-CLC10)**

- **Comtech EF Data LPOD*net* M&C Netbook Accessory for LPOD or SPOD PS 1, PS 1.5, PS 2 Operation Manual (CEFD P/N MN-LPODNET)**

Disclaimer

Comtech EF Data has reviewed this manual thoroughly in order to provide an easy-to-use guide to this equipment. All statements, technical information, and recommendations in this manual and in any guides or related documents are believed reliable, but the accuracy and completeness thereof are not guaranteed or warranted, and they are not intended to be, nor should they be understood to be, representations or warranties concerning the products described. Further, Comtech EF Data reserves the right to make changes in the specifications of the products described in this manual at any time without notice and without obligation to notify any person of such changes.

If there are any questions regarding this equipment or the information in this manual, please contact Comtech EF Data Product Support.

Conventions and References

Patents and Trademarks

See all of Comtech EF Data's Patents and Patents Pending at http://patents.comtechefdata.com.

Comtech EF Data acknowledges that all trademarks are the property of the trademark owners.

Warnings, Cautions, and Notes

> ⚠ **A <u>WARNING</u> informs you about a possible hazard that MAY CAUSE DEATH or SERIOUS INJURY.**

> ⚠ **A <u>CAUTION</u> informs you about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.**

> ① **A <u>NOTE</u> gives you important information about a task or the equipment.**

> 🔍 **A <u>REFERENCE</u> directs you to additional information about a task or the equipment.**

Examples of Multi-Hazard Notices
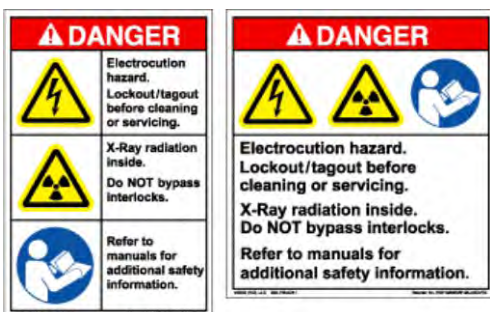
Recommended Standard Designations

The new designation of the Electronic Industries Association (EIA) supersedes the Recommended Standard (RS) designations. References to the old designations may be shown when depicting actual text (e.g., RS-232) displayed on the LPOD Web Server pages or serial remote interface. All other references in the manual refer to EIA designations.

> ⚠ **Carefully review the following information:**

Electrical Safety Notice

> ⚠ **CAUTION – NEUTRAL FUSING: DOUBLE POLE/NEUTRAL FUSING IS USED ON THE PRIME POWER SUPPLY INPUT.**

This equipment has been designed to minimize exposure of personnel to hazards. For further information, contact Comtech EF Data Product Support. The operators and technicians must:

- Know how to work around, with, and on high voltage equipment.

- Exercise every precaution to ensure personnel safety.

- Exercise extreme care when working near high voltages.

- Be familiar with the warnings presented in this manual.

Installation Guidelines Regarding Power Line Quality

Comtech EF Data has become familiar with the varying quality of the AC power grid around the world. Observing the following installation guidelines should help ensure a reliable installation.

- **Surge suppression:** High voltage surges can cause failure of the power supply. These surges are typically caused by circuit switching on the main AC power grid, erratic generator operation, and also by lightning strikes. While the LPOD does have built in surge suppression, if the unit is to be installed in a location with questionable power grid quality, Comtech EF Data recommends installation of additional power conditioning/surge suppression at the power junction box.

- **Grounding:** The LPOD provides a grounding terminal. This is provided to allow you to ground the LPOD to the antenna's grounding network. All components installed at the antenna should be grounded to a common grounding point at the antenna.

- **Electrical welding:** If welding needs to take place at the antenna, disconnect all cables from the LPOD except for the ground wire. Cap all RF connections with terminations. This will prevent damage to the input/output circuitry of the LPOD.

- **Lightning:** Lightning strikes on or around the antenna will generate extremely high voltages on all cables connected to the LPOD. Depending on the severity of the strike, the LPOD's internal surge protection combined with the recommended external suppression may protect the LPOD's power supply. However, if the installation will be in an area with a high probability of lightning strikes, Comtech EF Data recommends the installation of surge suppression on the RF and IF cables. One source of these suppressors is PolyPhaser (www.polyphaser.com).

Product Support

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

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Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty or a 90 day extended warranty, whichever is longer. Contact Comtech EF Data for the warranty period specific to the product purchased.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product.

The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Notes:

Chapter 1. INTRODUCTION

1.1 Overview

Comtech EF Data's LPOD family of Outdoor Amplifiers / Block Up Converters (BUCs) – referred to collectively throughout this manual as the **LPOD** – deliver their rated power, guaranteed, to the transmit waveguide flange at the 1 dB compression point. The LPOD provides a cost effective, more reliable replacement for Traveling Wave Tube (TWT) amplifiers in satellite communications.

Comtech EF Data's extensive experience in the design of outdoor RF transceivers led to the LPOD family's efficient thermal and mechanical package. Recognizing the evolution of L-Band IF systems, the LPOD is designed to eliminate the traditional requirement for the modem to supply a DC power source and a 10 MHz reference to the BUCs and LNBs.

LPOD PS 1   LPOD PS 1.5   LPOD PS 2

Figure 1-1. Comtech EF Data LPOD Outdoor Amplifiers / BUCs

1.2   Functional Description

The compact size and weight of the LPOD lends itself to any installation with limited available mounting space. These include ship-borne antenna systems, small "flyaway" systems, and Satellite News Gathering (SNG) installations. The addition of the optional internal reference and LNB bias T facilitates multi-carrier and redundant operations required of small-to medium-sized hub installations.

As shown in **Figure 1-1**, Comtech EF Data's LPOD is available in three models: the PS 1, PS 1.5 and PS 2. Each LPOD consists of a CEFD SSPA module with the **M**onitor/**C**ontrol **P**rocessor (MCP), a power supply, and a fan assembly. The amplifier features a Comtech EF Data low loss combining technique and MCP-based temperature-versus-gain compensation.

The PS 1 and PS 1.5 models are always configured as a BUC/SSPA (L-Band in, RF out) with available power levels to 100W; the PS 2 version can be configured as an integrated BUC/SSPA or solely as an SSPA (RF in, RF out) at power levels to 250W.

1.3   Features

1.3.1   The Solid-State Advantage

The LPOD is constructed with highly reliable gallium arsenide field-effect transistors (GaAs FETs). With third-order intermodulation products that are 4 to 6 dB better than TWT ratings, the CEFD unit replaces TWTs with saturated power levels of up to twice the LPOD's rated output. The LPODs also provide mean time between failures (MTBF) that is four to five times greater than the typical TWT MTBF.

1.3.2   Enhanced Standard Features

The LPOD comes equipped with useful features that other manufacturers offer only as options. Included in the base price are temperature compensation, sample ports (on the PS 2 only), power monitor, power factor corrected supply, and full remote monitor and control (M&C) capabilities (including Ethernet and serial).

1.3.3   Built-in Redundancy Controller

The LPOD has the ability to function as a 1:1 (one backup for one primary) redundant controller in a redundant mode without the use of an external device. The optional redundancy configuration is implemented by attaching a ganged waveguide/coax transfer switch(es) to the input and output connectors of the amplifiers, using a combination coaxial cable and waveguide kit.

When the backup LPOD is commanded into redundant mode, it monitors the online LPOD for faults and status, and automatically maintains a configuration based on the online unit.

A faulted online unit may be disconnected and replaced without affecting the online power amplifier.

1.3.4   "Smart BUC" Functionality

Comtech EF Data's unique approach to L-Band/RF frequency conversions eliminates DC and 10 MHz from the input coax. This simplifies redundant and multi-carrier operation. Full 13.75 to 14.5 GHz Ku coverage and 5850 to 6725 MHz C band coverage is offered while supporting industry standard FSK modem/BUC communications, as well as Comtech EF Data proprietary commands.

Both LPOD models have a self-contained power supply, eliminating the requirement for the modem to supply the BUC voltage on the center conductor of the RF cable, simplifying multi-carrier operation and modem spares maintenance.

1.3.5   Data Logging Capability

To greatly enhance system maintainability, the LPOD includes a built-in data logging capability. By recording critical operational parameters (such as temperature, output power, mute status, etc.) at time stamped intervals, the user can quickly gather intelligence not only about the unit itself, but also the unit's operational environment.

1.3.6   Optional Internal 10 MHz Reference

With the optional high stability, oven-controlled crystal oscillator (OCXO) installed, one more signal is removed from the TX IF cable. This ensures optimum RF performance of the BUC by eliminating any reference degradation caused by IF combiners, interconnections, or rotary joints.

1.3.7   Optional LNB Support

The LPOD was designed with the evolution of L-band systems in mind. L-band IF topologies are no longer relegated to low power single carrier installations, and are now found in larger multi-carrier installations. A challenge presented by multi-carrier L-band systems is the presence of DC and reference components on the Tx/Rx L-band interfaces. The LPOD design, by default, eliminates the DC component from the Tx IF and can eliminate the reference requirement with the optional internal OCXO. The LNB bias/reference option completes the solution by eliminating DC and reference signal requirements from the Rx L-band interface.

1.4   Theory of Operation

1.4.1   SSPA Block Diagrams

See **Figure 1-2** and **Figure 1-3** for the LPOD block diagrams. The major components of an LPOD unit are:

- SSPA Module
- Cooling System
- Monitor and Control (M&C)
- Power Factor Corrected Power Supply
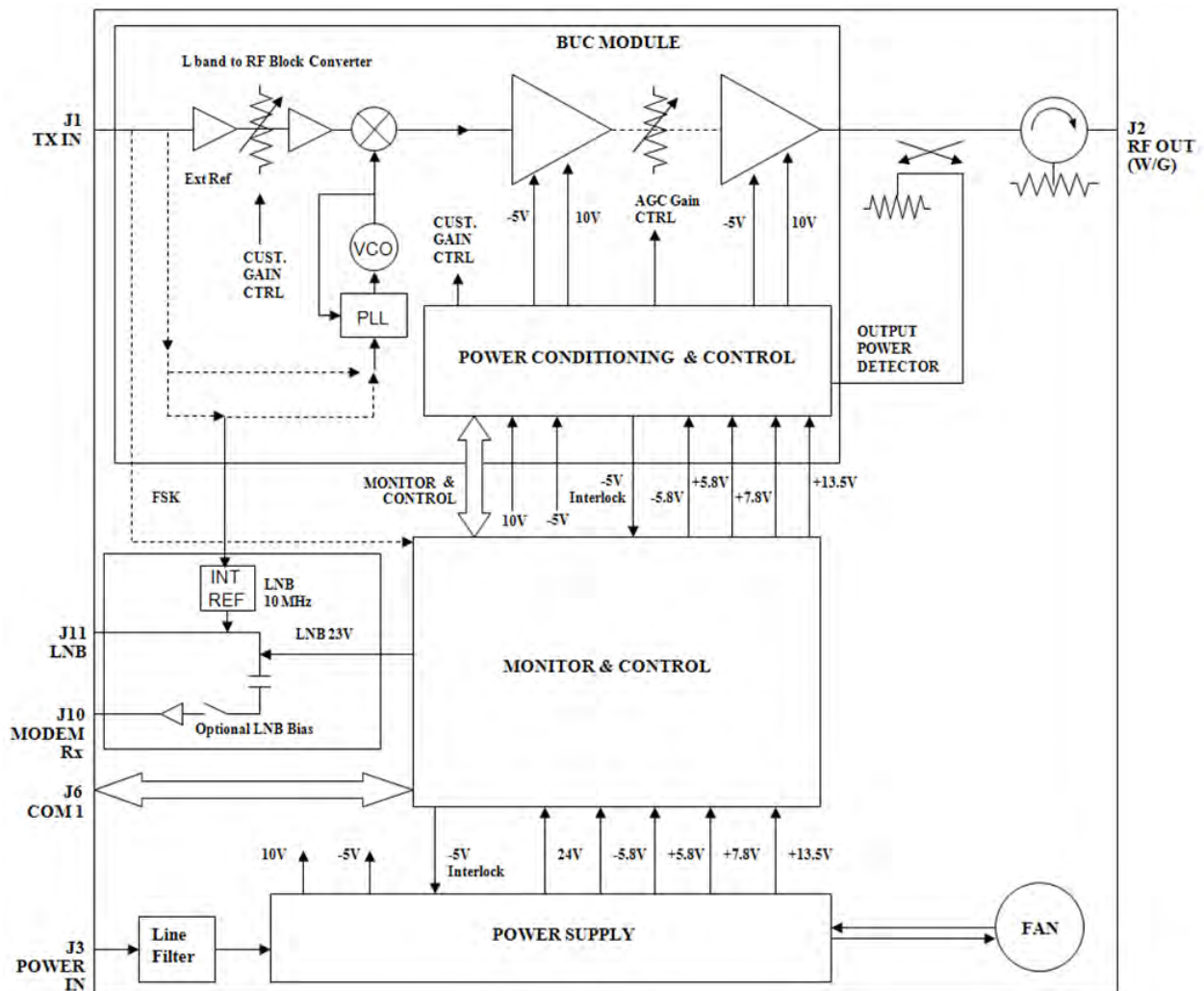
Figure 1-2. LPOD PS 1/1.5 Block Diagram
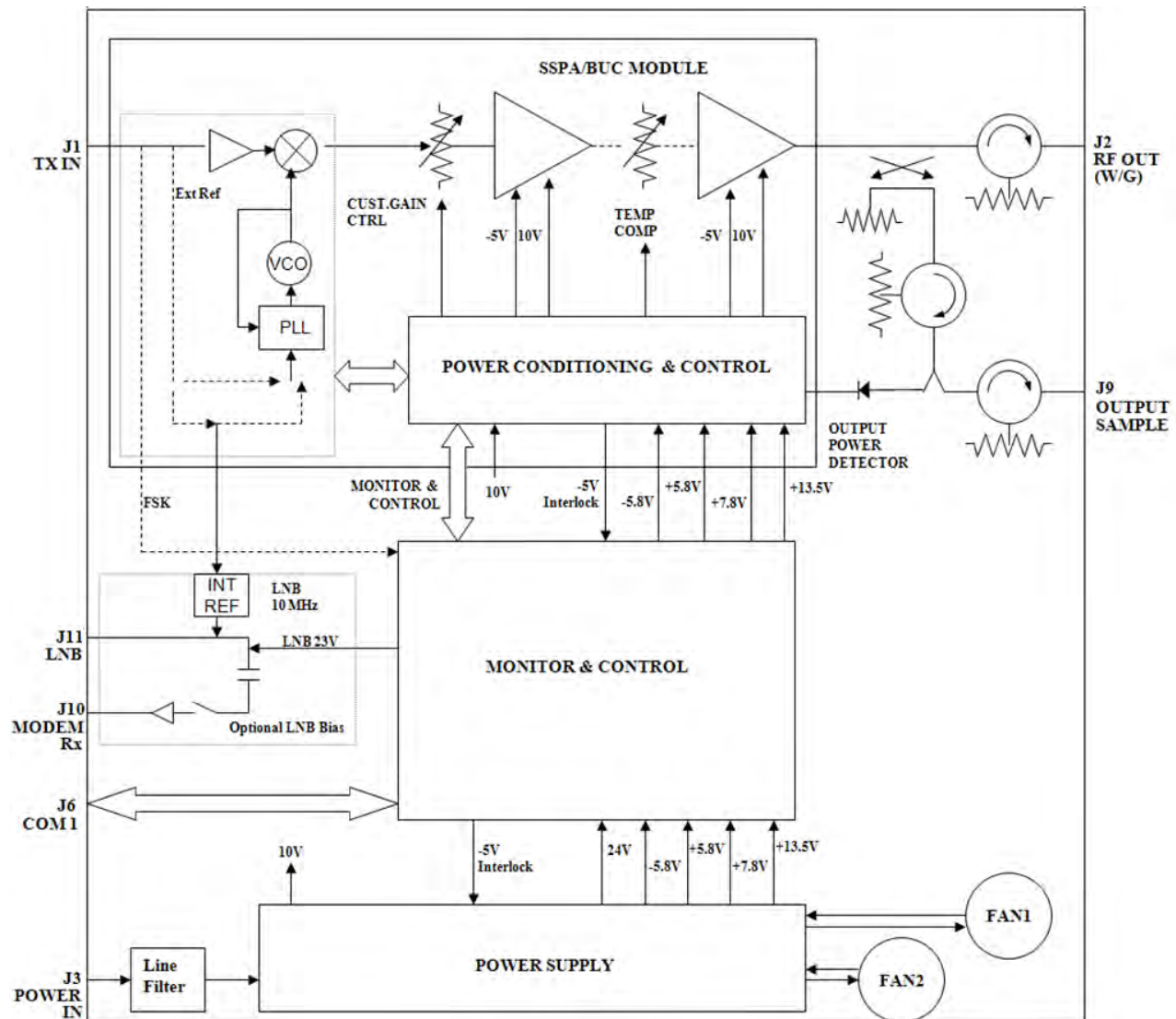
Figure 1-3. LPOD PS 2 Block Diagram

1.4.2   SSPA Module

The amplifier module performs the core function of the unit. An isolator is at the RF input to ensure good voltage standing wave ratio (VSWR). The RF signal then passes through an electronically controlled attenuator that adjusts the overall attenuation according to the user input. After some amplification, a second attenuator is automatically controlled via a look-up table to maintain the amplifier gain at a constant level over temperature variations.

The RF signal is then amplified by a multi-stage design that utilizes proprietary combining techniques to meet the rated power requirements. The output circuitry contains a coupler to provide a sampled signal for monitoring purposes. A power detector circuit also is included and the reading can be accessed via remote communication. A high power circulator and load is located at the output to provide good VSWR and protection from external mismatch.

1.4.3   Cooling System

The LPOD contains a robust heat sink and thermal design to maintain a low operating temperature. The PS 1 contains one temperature-controlled fan, and the PS 1.5 and PS 2 contain two temperature-controlled fans that are monitored by the M&C board. The fans draw cool outside air in across the power supply and specialized heat sink. The amplifier module temperature is monitored and, if for any reason the amplifier temperature exceeds a safe preset limit, the amplifier module supply is shut down to protect the unit from thermal failure.

1.4.4   Monitor and Control (M&C)

The LPOD includes a microprocessor-based system that provides monitoring and control of the essential parameters of the unit. The user interfaces with the unit through the M&C system via the remote control/discrete communications port. The unit is capable of either RS-232, RS-485, or Ethernet remote communication. A discrete mute control and relay status output is also available.

The M&C system monitors the fan speed (PS 2 only), unit temperature, all power supply voltages, power transistor currents, output power, etc. Should a critical monitored parameter fail, the unit will mute the RF signal and report a fault. The details of the fault can be accessed via remote communication.

The M&C is also capable of acting as a controller in a 1:1 redundant system. When configured as the back-up SSPA in such a system, it communicates with the other SSPA and toggles the waveguide switches as necessary.

1.4.5   LNB Operation

Either LPOD package style may be ordered with an optional internal 10MHz reference and Low Noise Block (LNB) converter bias tee. With these options installed, the user has control of the bias tee enable (LNB On/Off) as well as the DC bias voltage (On/Off).

1.4.6   Power Supply

The LPOD features a power supply that is power factor corrected. It supplies several voltages necessary for the unit to operate:

- The 10V power supply output state is controlled by circuitry within the RF module. If the RF module does not have the –5.8V supply for any reason, it will not allow the 10V power supply to turn on. This protects the power transistors within the RF module from failure due to improper power supply sequencing.

- The +24V output powers the cooling fans, is the source of power for waveguide switching when the SSPA is used in redundant configurations, and is dropped to +22V for LNB bias.

- The +5.8V, -5.8V, +7.8V and +13.5V outputs are used to operate the M&C board and other overhead functions.

1.4.7   Block Up Converter (BUC) Input

The LPOD translates an L-Band input carrier to the desired output frequency (C-, X-, or Ku-Band). LO frequencies are as follows:

BUC C, Ku, X LO Frequencies			
Band	**Frequency**	**LO Frequency**	**Inverting**
C-Band	5850 to 6650 MHz	4900 MHz	No
	5950 to 6700 MHz	5000 MHz	No
Insat C-Band	6725 to 7025 MHz	5760 MHz	No
X-Band	7900 to 8400 MHz	6950 MHz	No
Ku-Band	14.00 to 14.50 GHz	13.050 GHz	No
Ku-Band-W	13.75 to 14.50 GHz	12.800 GHz	No

Unlike most BUCs, no DC bias voltage should be provided on the center conductor of the L-Band coax. In addition, the LPOD is available with an internal 10 MHz reference. As, such, no 10 MHz reference is required on the center conductor of the L-Band coax. If a reference is provided on the coax, the internal reference will detect and lock to it.

1.5   Summary of Specifications

1.5.1   Characteristics

IF Input Frequency [Note 1]	RF Output Frequency
950 – 1525 MHz	5.850 – 6.425 GHz
950 – 1750 MHz	5.850 – 6.650 GHz (optional)
950 – 1825 MHz	5.850 – 6.725 GHz (optional)
965 – 1265 MHz	6.725 – 7.025 GHz
950 – 1450 MHz	7.900 – 8.400 GHz
950 – 1450 MHz	14.00 – 14.50 GHz
950 – 1750 MHz	13.75 – 14.50 GHz (optional)

Model	Psat (Typical)	P1dB (Guaranteed) [Note 2]
PS1-25C,X	44 dBm (25 W)	43 dBm (20 W)
PS1-32C,X	45 dBm (32 W)	44 dBm (25 W)
PS1-40C,X	46 dBm (40 W)	45 dBm (32 W)
PS1-50C,X	47 dBm (50 W)	46 dBm (40 W)
PS1-60C,X	48 dBm (60 W)	47 dBm (50 W)
PS1-20Ku	43 dBm (20 W)	42 dBm (16 W)
PS1-32Ku	45 dBm (32 W)	44 dBm (25 W)
PS1-40Ku	46 dBm (40 W)	45 dBm (32 W)
PS1.5-75C,X	48.6 dBm (75 W)	48 dBm (60 W)
PS1.5-80C,X	49 dBm (80 W)	48.5 dBm (70 W)
PS1.5-100C,X	50 dBm (100 W)	49 dBm (80 W)
PS1.5-110C,X	50.4 dBm (110 W)	49.5 dBm (90 W)
PS1.5 or PS2-125C,X	51 dBm (125 W)	50 dBm (100 W)
PS1.5-50Ku	47 dBm (50 W)	46 dBm (40 W)
PS1.5-60Ku	48 dBm (60 W)	47 dBm (50 W)
PS2-150C,X	51.8 dBm (150 W)	51 dBm (125 W)
PS2-200C,X	53 dBm (200 W)	52.5 dBm (175 W)
PS2-250C,X	54 dBm (250 W)	53 dBm (200 W)
PS2-100Ku	50 dBm (100 W)	49 dBm (80 W)
PS2-125Ku	51 dBm (125 W)	50 dBm (100 W)

Notes:
1. PS 2 Models available as SSPAs only, without internal L-Band BUC (Freq RF in = Freq RF out).
2. Allow 1 dB degradation from 13.75 to 14.0 GHz and 6425 to 6725 MHz.

Gain Min (Typical)	70 (75 dB)
Input Power Supply Requirements	90-264 VAC, 47-63 Hz, Power Factor Corrected, .96 (typical) (48 VDC optional)
Max IF Input level (no damage)	+10 dBm
Gain Adjust	20 dB in 0.25 dB steps
Gain Flatness	± 1.5 dB full band (optional ± 2.0 dB full band (-50° to +55°C)) ± 0.30 dB per 40 MHz (optional ± 0.50 dB per 40 MHz (-50° to +55°C)
Gain variation over temp	±1.5 dB max, -40° to +55°C (optional ± 2.0 dB max (-50° to +55°C))

Input Return Loss	15 dB
Output Return Loss	19.1 dB (1.25:1 VSWR)
Noise Figure	10-15 dB typ, 20 dB max @ min attenuation, (8 dB typ, 15 dB max PS2 configured as SSPA only)
RF Mute Isolation	-60 dBc min
AM/PM Conversion	2° typ, 3.5° max @ Rated P1dB
Third-order Intermodulation Level (2 tones, @ -3 dB Total Backoff from P1 dB (-6 dBc SCL), Δ 1MHz)	-30 dBc typ, -25 dBc Guaranteed

Spurious Level	Harmonics	-50 dBc @ Prated – 3 dB
	Carrier Related In Band	-60 dBc min @ P1dB
	Non-Carrier Related In Band	-60 dBm max (Input Terminated)
	LO Leakage	-25 dBm max

Group delay variation	Linear	± 0.03 ns/MHz
	Parabolic	±0 .003 ns/MHz^2
	Ripple	± 1.0 ns pk-pk

Data Logging Parameters	Non-Volatile RAM: Capacity 30 days @ 90 minute intervals. Includes: • RF Output Power • Mute Status • Heatsink Temperature • LNB Bias Current

Phase Noise (dBc/Hz) (with optional internal or equivalent performance external reference)		Typical (C/X/Ku) dBc/Hz	Spec (C/X/Ku) dBc/Hz
Offset	100 Hz	-79/-78/-76	-72/-72/-69
	1 KHz	-91/-87/-85	-84/-84/-82
	10 KHz	-105/-104/-98	-97/-97/-90
	100 KHz	-120/-114/-114	-107/-107/-102
	1 MHz	-132/-132/-132	-115/-115/-115

1.5.2   Optional Internal Reference

Internal Reference Oscillator Frequency	10 MHz (can lock to modem supplied reference over a range of -5 dBm to +5 dBm at IF Input)
Frequency Stability	±5 x 10^{-10}/day
	±1 x 10^{-8} (-40º to 55ºC)

1.5.3   Optional LNB Bias / Reference

LNB Bias Voltage	Software selectable tone on/off, 12/18V, 450 mA max
LNB 10 MHz Reference Output Level	0 dBm ±5 dB
LNB Input / Output Return Loss	15 dB
LNB Input / Output Gain	10 dB ± 2 dB (950-1750 MHz) -1 dB ± 2 dB (optional)
LNB Input / Output Gain Flatness	± 1 dB (950-1750 MHz)
LNB input / Output Isolation (Mute condition)	55 dB min

1.5.4   Environmental

Temperature	**Operating**	**Standard**	-40º to 122ºF (-40º to 55ºC)
		Optional	-40º to 140ºF (-40º to 60ºC)
	Storage		-67º to 167ºF (-55º to 75ºC)
Humidity			100% condensing rain 2" per hour
Altitude			10,000 AMSL
Shock			Normal commercial shipping and handling

1.5.5   Physical

Weight	**PS 1**		17 lbs. (9.1 kg) Nominal
	PS 1.5		
	PS 2		47 lbs (21.32 kg) Nominal
Dimensions (excluding connectors) See Sect. 1.6 for all dimensional envelope figures	**PS 1**		12.65 x 6.26 x 7.37 in. (321.3 x 159 x 187.2 mm)
	PS 1.5		12.78 x 6.14 x 7.05 in. (324.6 x 156 x 179.1 mm)
	PS 2		16.18 x 8.80 x 9.78 x in. (427 x 223.5 x 248.4 mm)
Connectors	**IF/RF Input**		Type 'N' Female
	RF Output	**PS 1**	C-Band / X-band: Type 'N' Female (standard), CPR137G (optional) Ku-Band: WR75G
		PS 1.5	C-Band: CPR137G X-Band: CPR112G Ku-Band: WR75G
		PS 2	C-Band: CPR137G X-Band: CPR112G Ku-Band: WR75G
	LNB Bias		Type 'N' Female
	M&C/Ethernet/ Redundancy Switches		19-pin MS style (single integrated cable assembly available, dependent upon configuration)

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1.6   Dimensional Envelopes

- **Typical for all figures in each subsection, all dimensions are in inches. Bracketed dimensions, where shown, are in metric units (mm).**

- **Unless otherwise noted, all figures depict AC Option, Waveguide Output units.**

Subsection / Product	FIGURE	DESCRIPTION
1.6.1 LPOD PS 1	1-4	PS 1 C-Band Dimensional Envelope (Coaxial Output)
	1-5	PS 1 C-Band Dimensional Envelope (Waveguide Output)
	1-6	PS 1 X-Band Dimensional Envelope
	1-7	PS 1 Ku-Band Dimensional Envelope
1.6.2 LPOD PS 1.5	1-8	PS 1.5 C-Band Dimensional Envelope (DC Option)
	1-9	PS 1.5 X-Band Dimensional Envelope
	1-10	PS 1.5 Ku-Band Dimensional Envelope
1.6.1 LPOD PS 2	1-11	PS 2 C-Band Dimensional Envelope
	1-12	PS 2 X-Band Dimensional Envelope
	1-13	PS 2 Ku-Band Dimensional Envelope

1.6.1   LPOD PS 1 Dimensional Envelopes

Figure 1-4. LPOD PS 1 C-Band Dimensional Envelope (Coax Output)

Figure 1-5. LPOD PS 1 C-Band Dimensional Envelope (Waveguide Output)
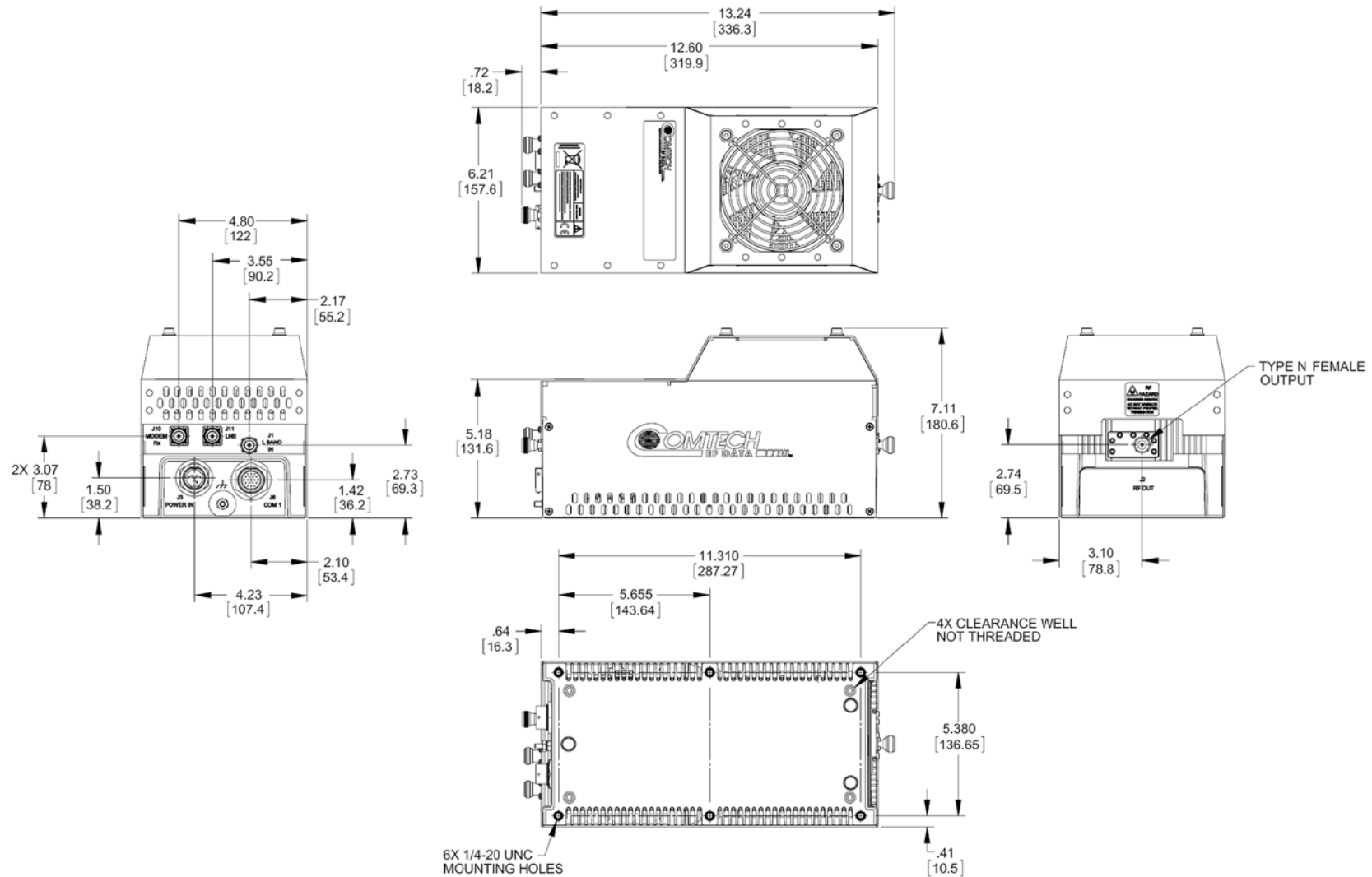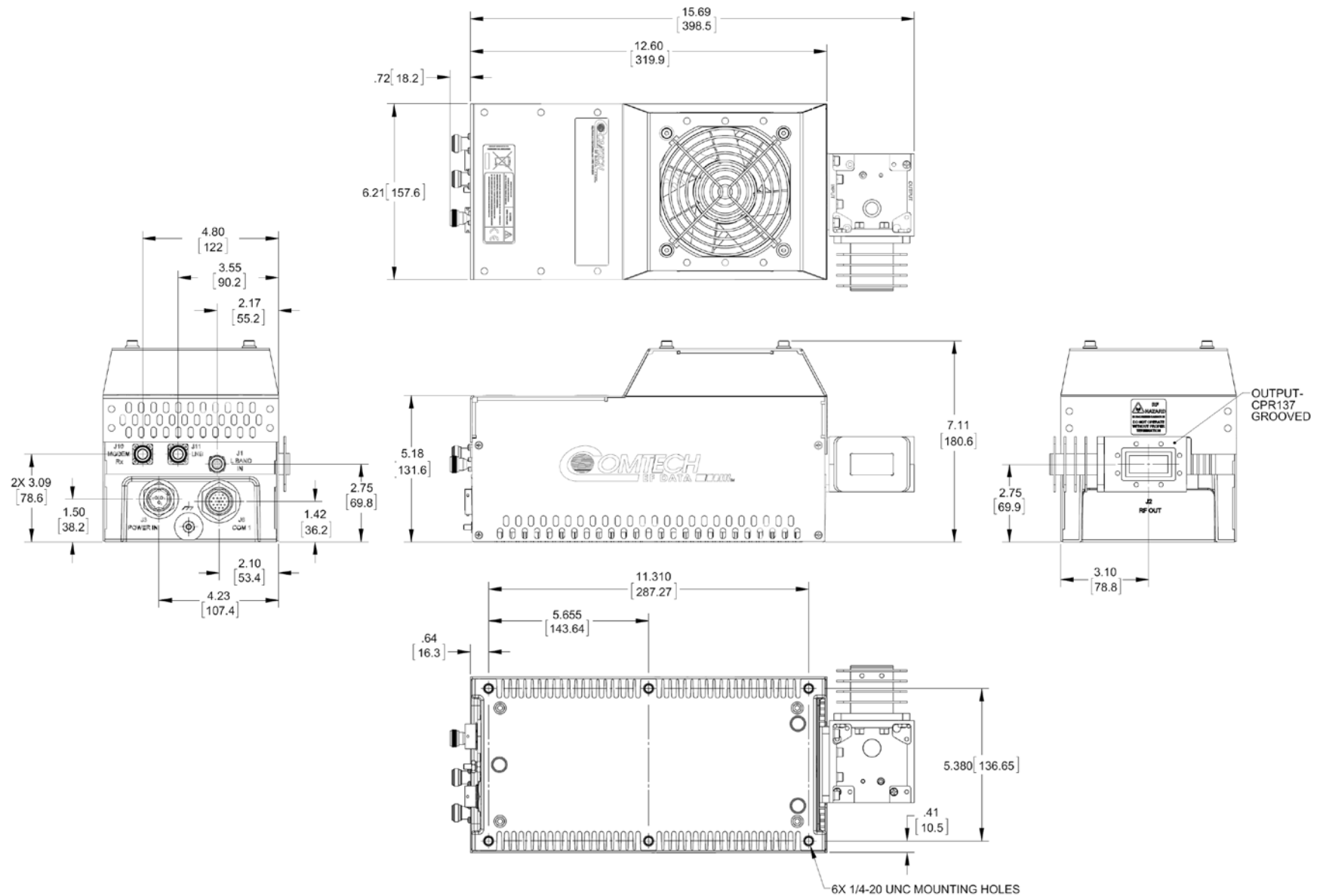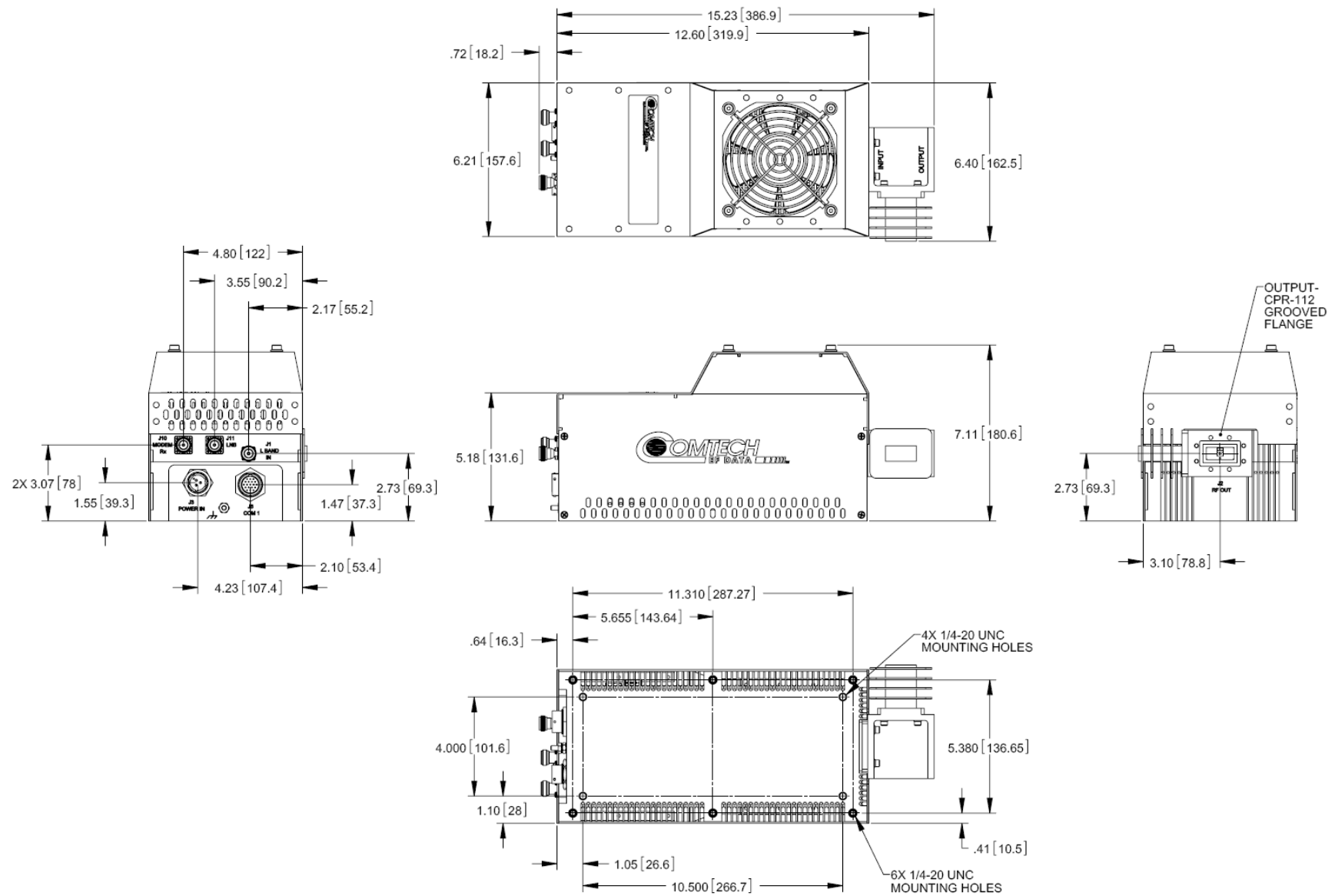
Figure 1-6. LPOD PS 1 X-Band Dimensional Envelope

Figure 1-7. LPOD PS 1 Ku-Band Dimensional Envelope

1.6.2   LPOD PS 1.5 Dimensional Envelopes

Figure 1-8. LPOD PS 1.5 C-Band Dimensional Envelope (DC Option)
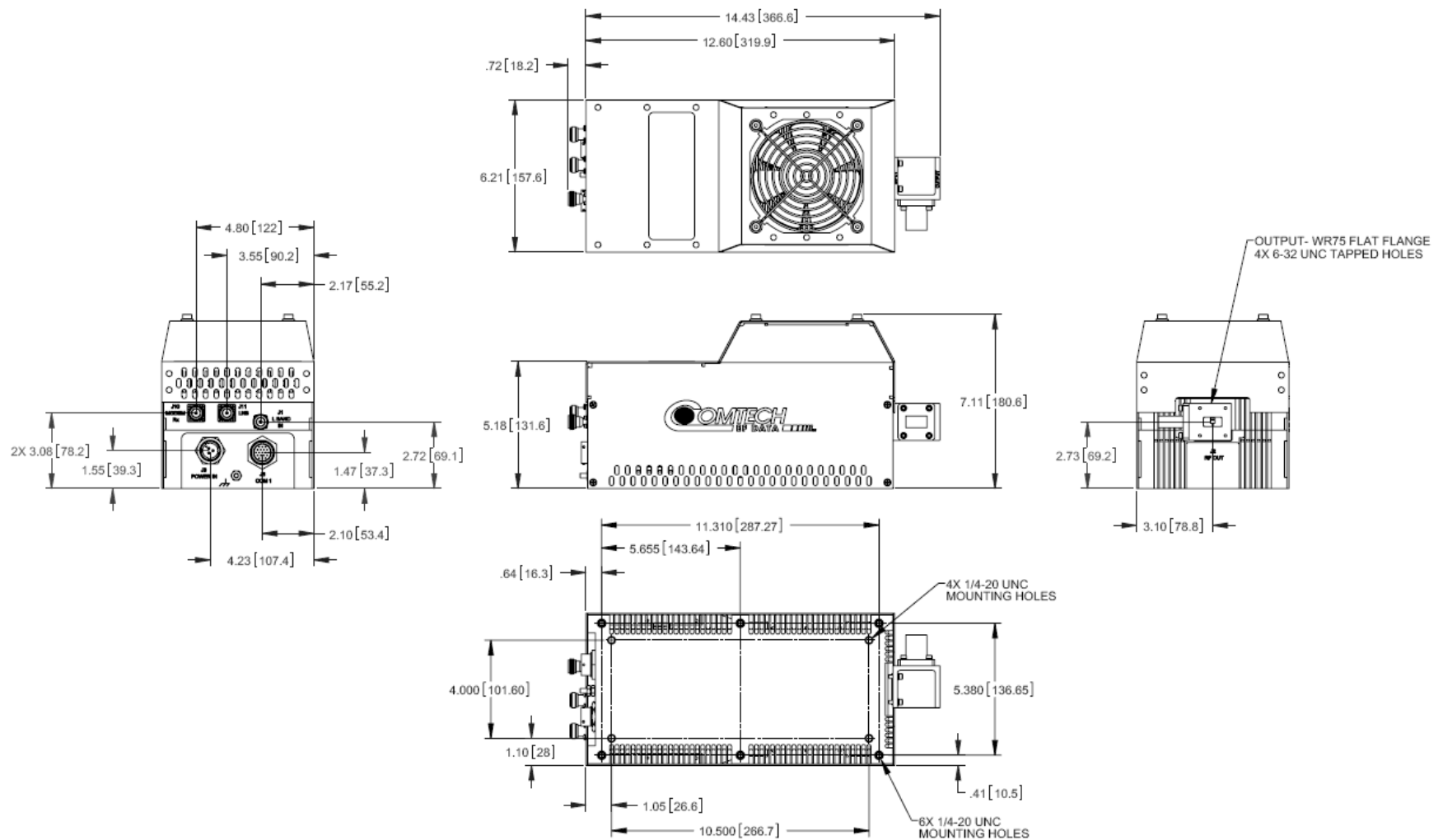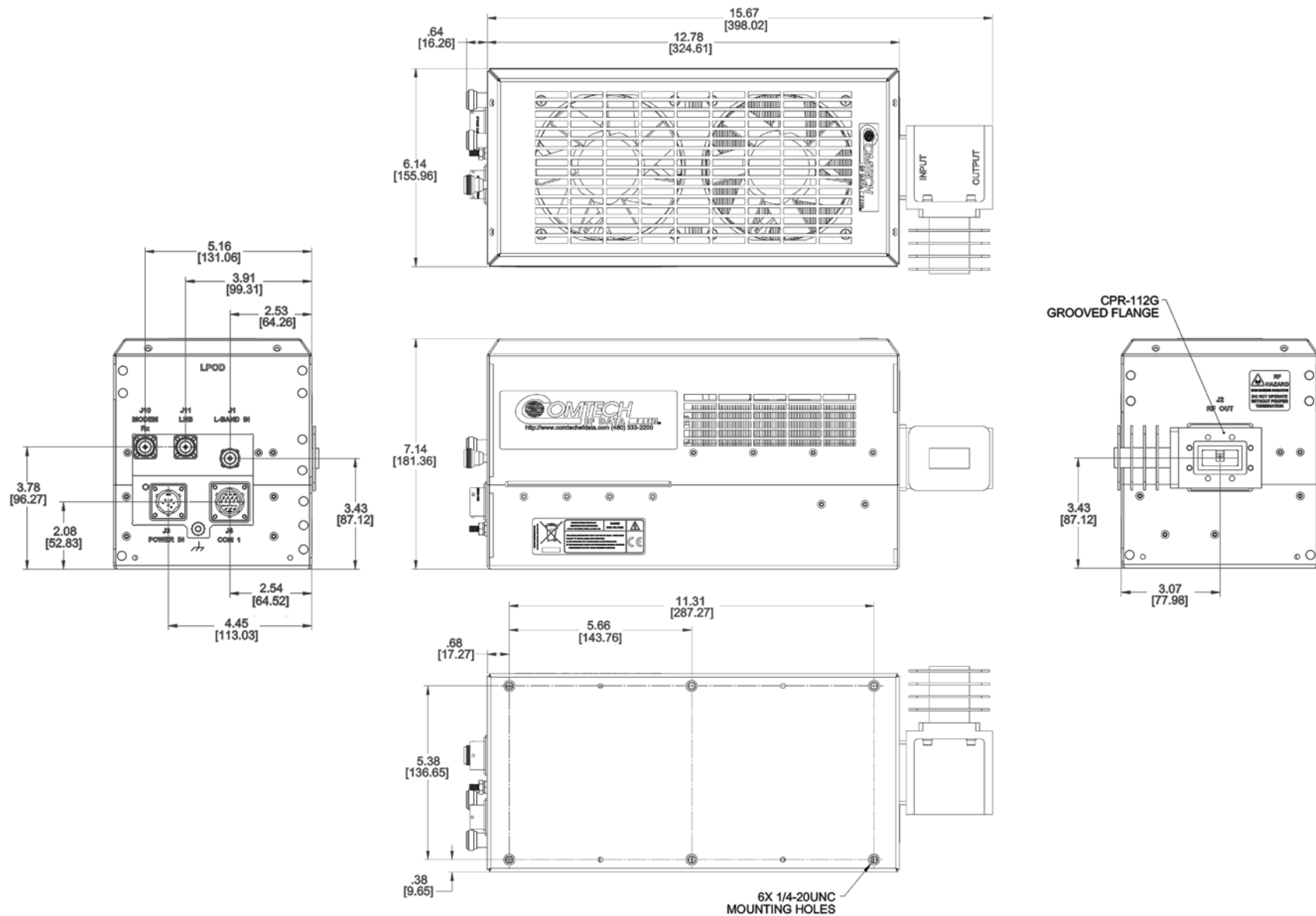
Figure 1-9. LPOD PS 1.5 X-Band Dimensional Envelope
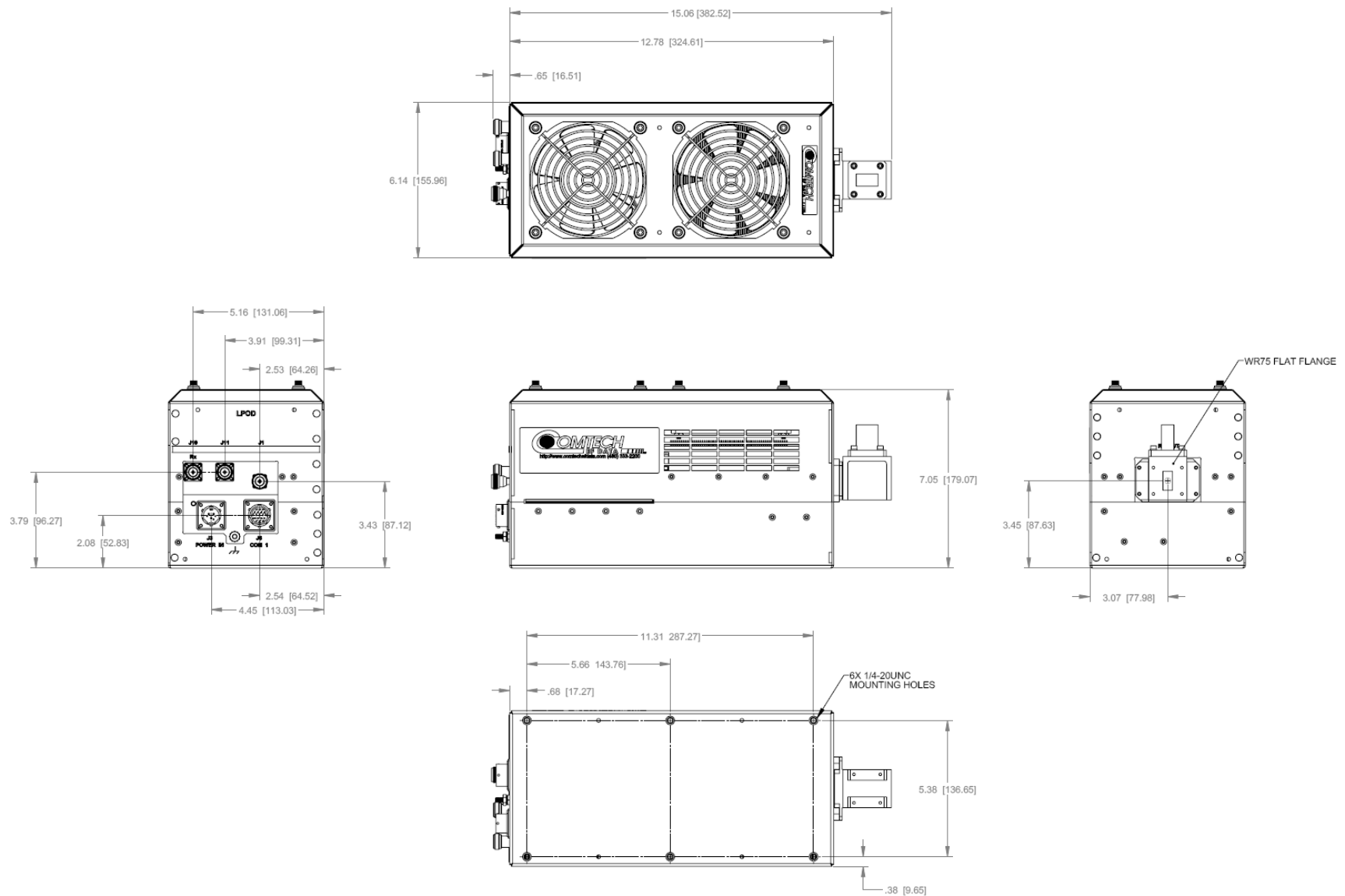
Figure 1-10. LPOD PS 1.5 Ku-Band Dimensional Envelope

1.6.3   LPOD PS 2 Dimensional Envelopes

Figure 1-11. LPOD PS 2 C-Band Dimensional Envelope
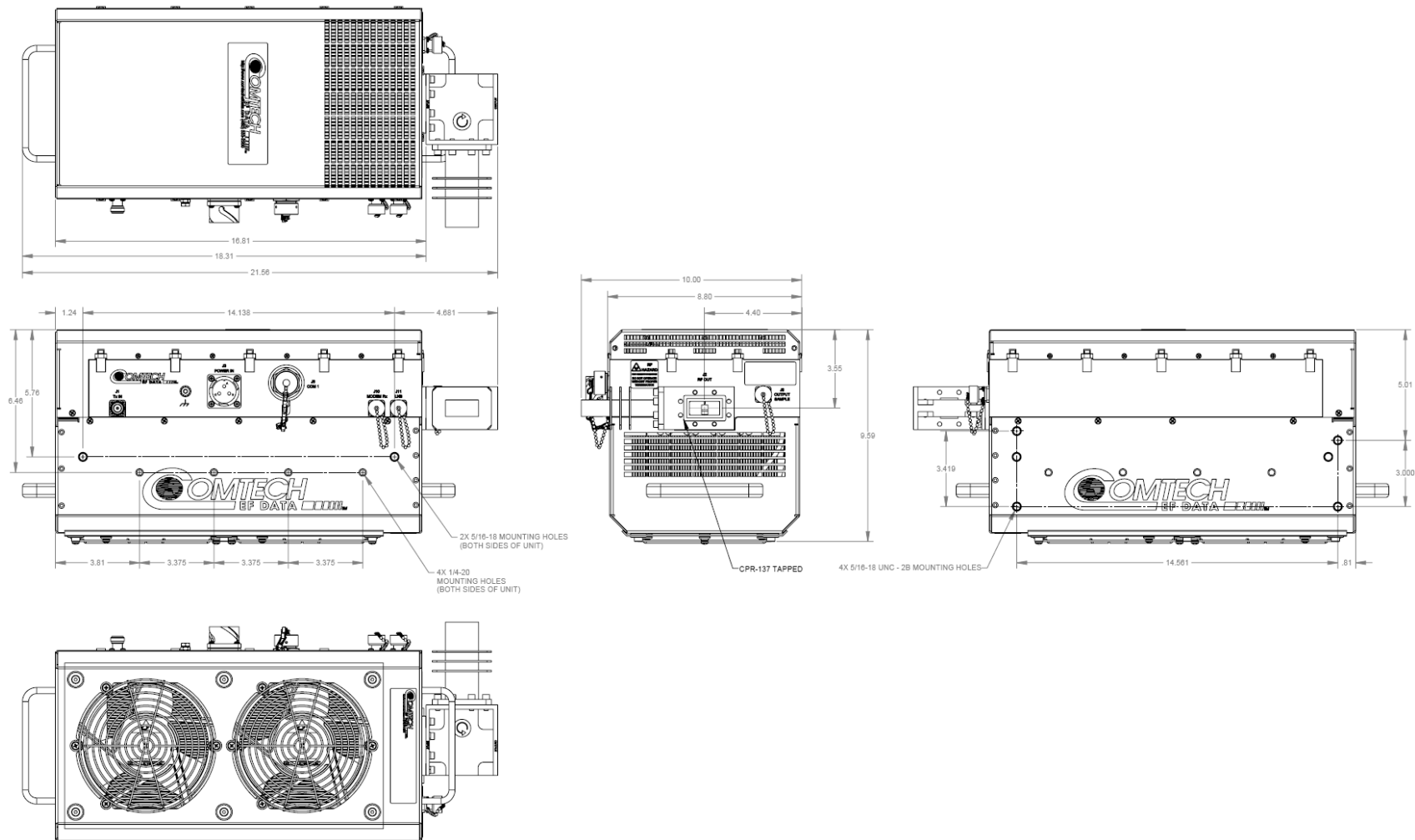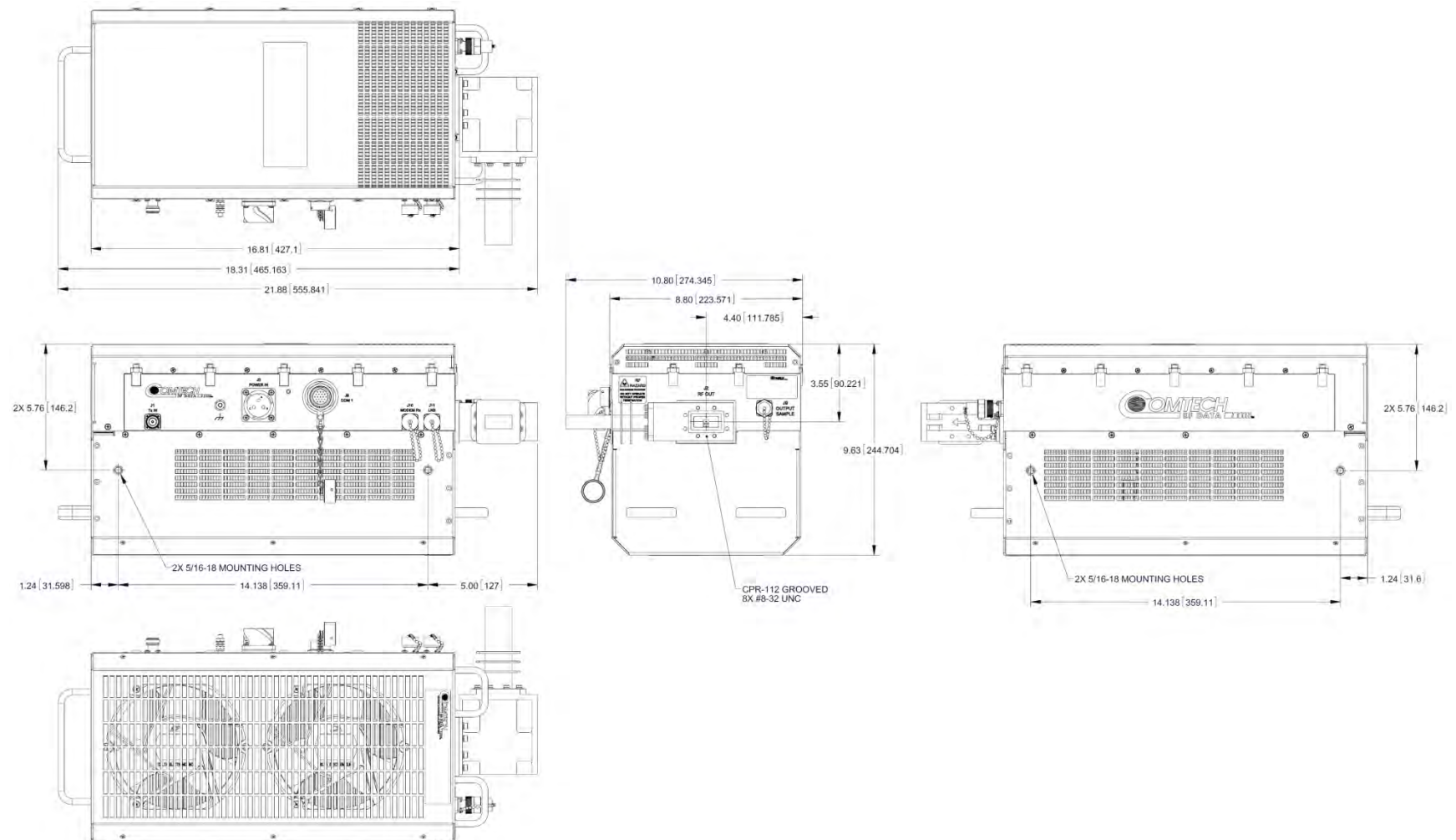
Figure 1-12. LPOD PS 2 X-Band Dimensional Envelope
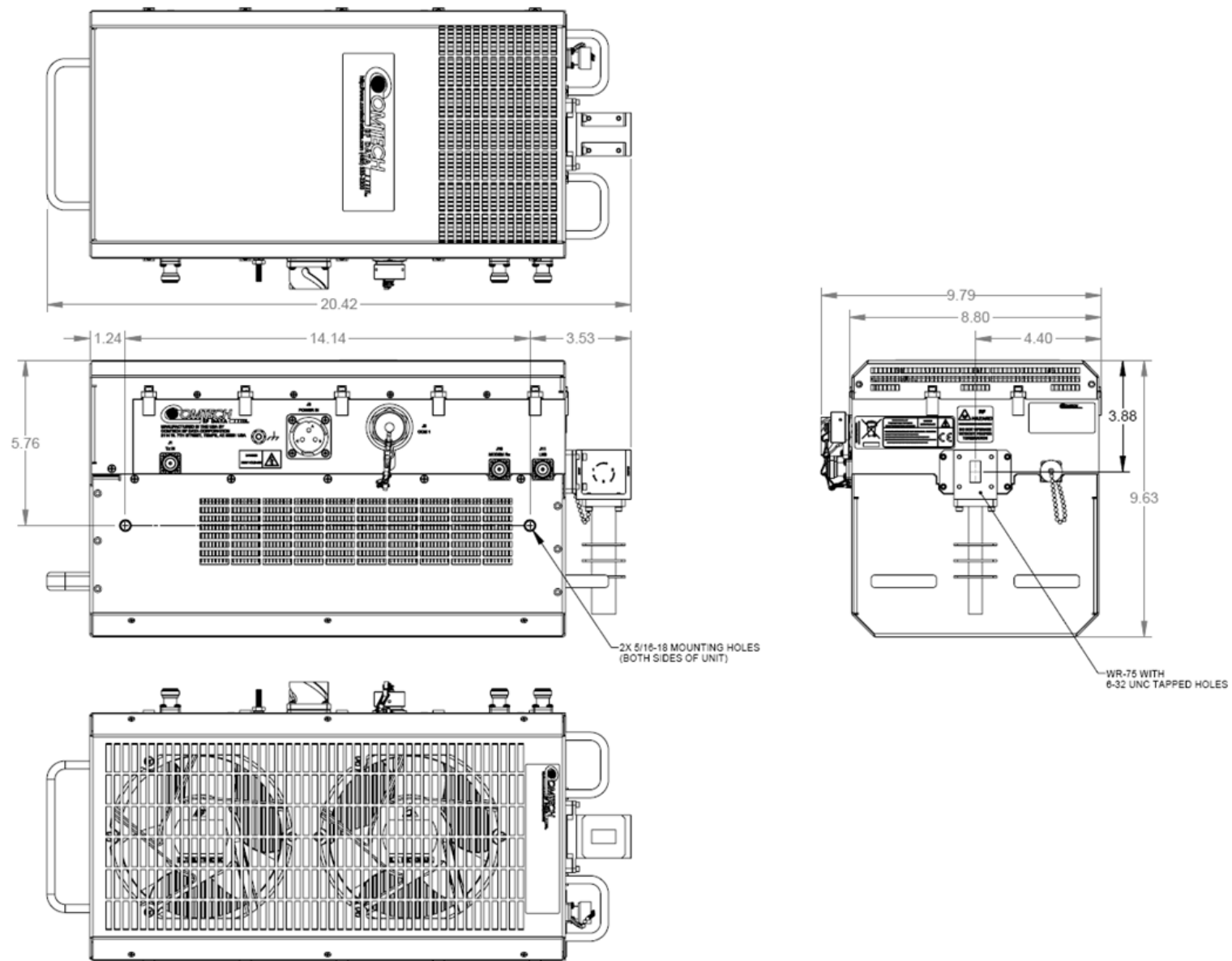
Figure 1-13. LPOD PS 2 Ku-Band Dimensional Envelope

Chapter 2. SYSTEM CONNECTIONS, INSTALLATION AND STARTUP

2.1 Cabling Connection Types

2.1.1 Coaxial Cable Connections

Coupling Type	Connector Type	
	Plug	Jack
Threaded (Type 'N' shown)		

Figure 2-1. Coaxial Connector Example

The SPOD SSPA uses Type 'N' coaxial cables. Type 'N' Coaxial cables (plugs) and their mating connectors (jacks/sockets) are available in a *threaded coupling* style (**Figure 2-1**). The jack for this coupling style features external threads. The plug shell features internal threads, and has either a knurled outer surface (to permit hand tightening of the connection) or hex flats (to accommodate torqued installation).

Connection Instructions – Engage the plug onto the jack threads, and then turn the plug clockwise until it is fully threaded onto the jack. Do not over-tighten the connection.

2.1.2 Circular Cable Connections

The circular connectors provided on the SPOD SSPA accommodate weatherproof outdoor applications. The connector pairs (**Figure 2-2**) feature a sleeve lock configuration, with an array of pins (male side) coupled to mating sockets (female side).
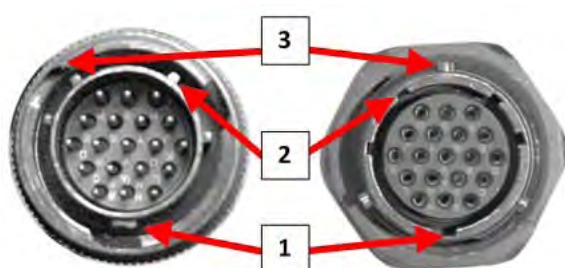
Feature	Description
1	Primary Alignment features
2	Secondary Alignment features
3	Sleeve Lock features

Figure 2-2. Circular Connector Example

Connection Instructions – Engage all of the alignment and lock features between the male connector (on the interconnection cable) and female socket.

To install the male connector into the female connector, do these steps:

1) Engage the primary and secondary alignment tabs on the male connector with the mating cutouts on the female socket.

2) Push the male connector into the female socket.

3) Turn the male connector sleeve clockwise until the sleeve lock cutouts engage fully with the female socket tabs and you hear a "click" sound.

2.2 LPOD Cabling Connections

The LPOD external connectors provide all necessary connections between the LPOD PS 1 (**Figure 2-3**), PS 1.5 (**Figure 2-4**), or PS 2 (**Figure 2-5**) models and other equipment. Additionally:

- Detailed installation and operational information for using the LPODs in 1:1 redundancy configurations is provided in **Appendix A. 1:1 REDUNDANCY**.

- Information on the LPOD's remote M&C functionality via Ethernet is provided in **Chapter 4. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT**.

- Information on the LPOD's remote M&C functionality via serial-based commands and queries is provided in **CHAPTER 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT**.
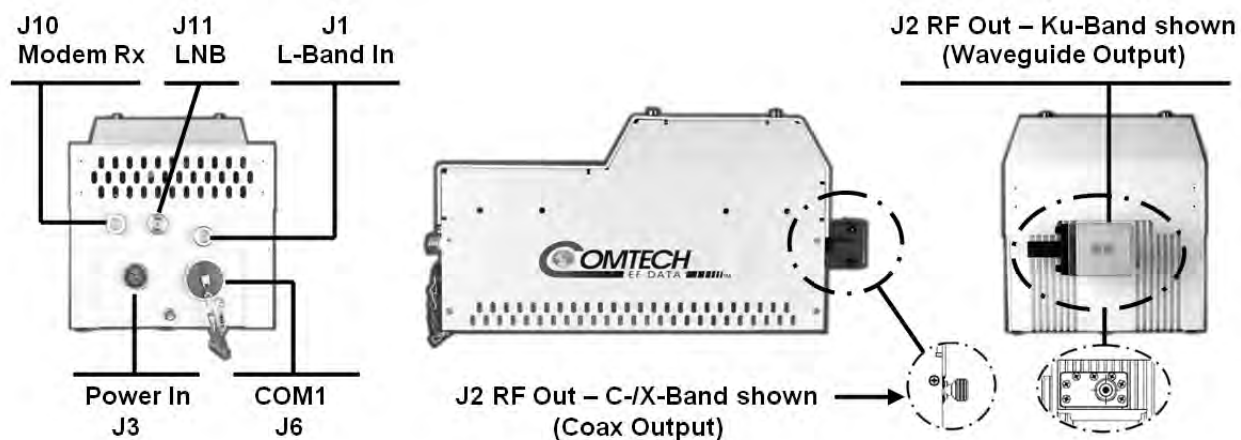
Figure 2-3. LPOD PS 1 Connectors
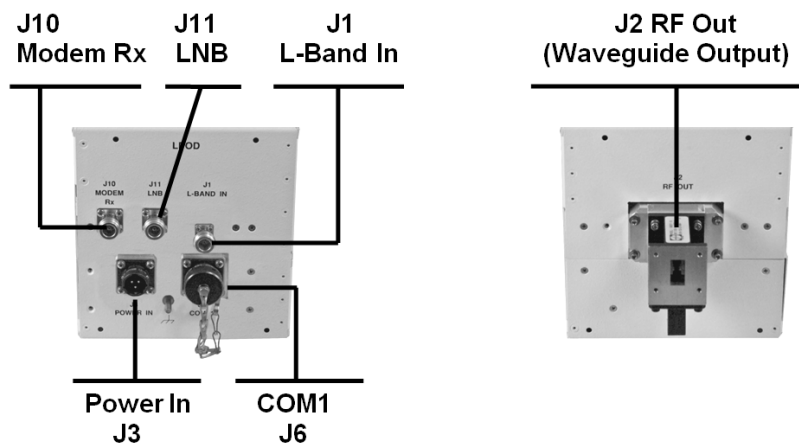
Figure 2-4. LPOD PS 1.5 Connectors
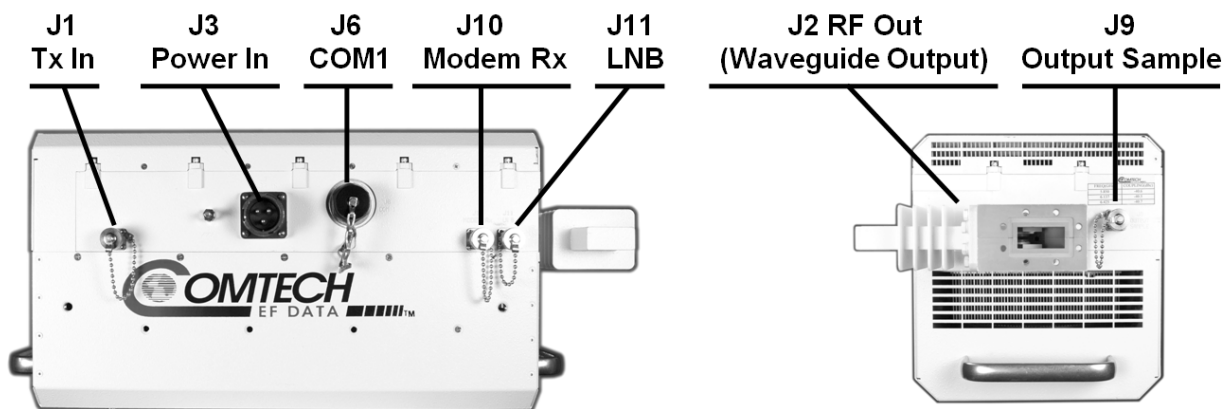
Figure 2-5. LPOD PS 2 Connectors

2.3   Interface Connectors

2.3.1 Connector 'J1 | LBAND IN' or 'J1 | Tx IN'

PS 1/PS 1.5   PS 2

The RF input connector is a Type 'N' female connector. Labeled '**J1 | LBAND IN**' on the LPOD PS 1 and PS 1.5 models or '**J1 | Tx IN**' on the LPOD PS 2 unit, typical input levels (-30 dBm) depend on desired output power and unit attenuation. To prevent damage to the LPOD, RF input levels should not exceed +15 dBm.

2.3.2 Connector 'J2 | RF OUT'

> **WARNING! FOR SAFETY REASONS, NEVER LOOK DIRECTLY INTO THE WAVEGUIDE OUTPUT.**

The **'J2 | RF OUT'** connector may be a waveguide or coaxial interface – the type of interface used depends on the LPOD model and/or frequency range of the unit, as described in **Table 2-1** and as shown in **Figure 2-3**, **Figure 2-4**, and **Figure 2-5**.

Table 2-1. 'J2 | RF OUT' Interface Type

Unit	Frequency Band	Output Type	FIGURE
PS 1	C	Type 'N' Female (Standarsd) CPR137G (Optional)	2-1
	X	CPR112G (Waveguide)	
	Ku	WR75G (Waveguide)	
PS 1.5	C	CPR137G (Waveguide)	2-2
	X	CPR112G (Waveguide)	
	Ku	WR75G (Waveguide)	
PS 2	C	CPR137G (Waveguide)	2-3
	X	CPR112G (Waveguide)	
	Ku	WR75G (Waveguide)	

2.3.3 Connector 'J3 | POWER IN' (AC Power Mains)

⚠️	**WARNING! FOR SAFETY REASONS, TAKE CARE TO NOTE THAT THE 'J3' AC POWER CONNECTION PIN ASSIGNMENTS FOR EACH SPOD UNIT ARE NOT THE SAME. FAILURE TO CAREFULLY REVIEW THE INFORMATION PROVIDED IN THE SECTIONS THAT FOLLOW MAY RESULT IN PRODUCT DAMAGE OR PERSONAL INJURY.**

For all LPOD models, the prime power input requirement is as follows:

* 90-264 VAC

* 47-63 Hz

* The power supply is power factor corrected. The total power required from the prime power supply depends on the model used. Please refer to **Sect. 1.5 Summary of Specifications**.

2.3.3.1 LPOD PS 1, PS 1.5 'J3 | POWER IN' (AC Power Main)

The mating connector specification and pin assignments (**Table 2-2**) unique to the LPOD PS 1 and PS 1.5 AC power interfaces are as follows:

Mating Connector: CEFD P/N CN/MS-STPG03F02 (ITT Cannon KPT06B-12-35).

Table 2-2. LPOD PS 1/PS 1.5 'J3 | POWER IN' Pin Assignments

Pin	Description
A	LINE (L1)
B	NEUTRAL (L2)
C	GND

2.3.3.2 LPOD PS 2 'J3 | POWER IN' (AC Power Main)

The mating connector specification and the pin assignments (**Table 2-3**) unique to the LPOD PS 2 AC power interface are as follows:

Mating Connector: CEFD P/N CN/MS-STPG03F07 (Glenair ITS-3106F20-19SF7).

Table 2-3. LPOD PS 2 'J3 | POWER IN' Pin Assignments

Pin	Description
A	GND
B	NEUTRAL (L2)
C	LINE (L1)

2.3.4 Connector 'J3 | POWER IN' (DC Power Mains)

	WARNING! FOR SAFETY REASONS, TAKE CARE TO NOTE THAT THE 'J3' DC POWER CONNECTION PIN ASSIGNMENTS FOR EACH SPOD UNIT ARE NOT THE SAME. FAILURE TO CAREFULLY REVIEW THE INFORMATION PROVIDED IN THE SECTIONS THAT FOLLOW MAY RESULT IN PRODUCT DAMAGE OR PERSONAL INJURY.

For all LPOD models, the prime power input requirement is 38-72 VDC. The total power required from the prime power supply depends on the model used. Please refer to **Sect. 1.5 Summary of Specifications**.

2.3.4.1 LPOD PS 1 'J3 | POWER IN' (DC Power Main)

The mating connector specification and the pin assignments (**Table 2-4**) unique to the LPOD PS 1 DC power interface are as follows:

Mating Connector: CEFD P/N CN/STPG04F01 (Glenair IPT06E-12-4-SSR-F7).

Table 2-4. LPOD PS 1 'J3 | POWER IN' Pin Assignments

Pin	LPOD PS 1 Assignment
A	V+
B	GND
C	V-
D	NO CONNECT

2.3.4.2 LPOD PS 1.5 'J3 | POWER IN' (DC Power Main)

The mating connector specification and the pin assignments (**Table 2-5**) unique to the LPOD PS 1.5 DC power interface are as follows:

Mating Connector: CEFD P/N CN-0020517 (MS3116E-14-5S(476), Amphenol PT06E-14-5S(476)).

Table 2-5. LPOD PS 1.5 'J3 | POWER IN' Pin Assignments

Pin	LPOD PS 1.5 Assignment
A	+48V
B	+48V
C	-48V
D	-48V
E	GND

2.3.4.3 LPOD PS 2 'J3 | POWER IN' (DC Power Main)

The mating connector specification and the pin assignments (**Table 2-6**) unique to the LPOD PS 2 DC power interface are as follows:

Mating Connector: CEFD P/N CN/CA3106E2222SB (ITT Cannon CA3106E22-22SB).

Table 2-6. LPOD PS 2 'J3 | POWER IN' Pin Assignments

Pin	LPOD PS 2 Assignment
A	V+
B	NO CONNECT
C	NO CONNECT
D	V-

2.3.4.4 LPOD PS 2 'J3 | POWER IN' 48VDC Power Main Option

The connector type and mating connector specification and the pin assignments (**Table 2-7**) unique to the LPOD PS 2 48 VDC power interface option are as follows:

Unit Connector Type: CEFD P/N CN-0000288 (ITT Cannon CA3102E20-15SB-F80A232).

Supplied Mating Connector: CEFD P/N CN-0000289 (ITT Cannon CA3106E20-15SB-F80A232).

Table 2-7. LPOD PS 2 'J3 | POWER IN' 48VDC Pin Assignments

Pin	LPOD PS 2 Assignment
A	V+
B	V+
C	NO CONNECT
D	NO CONNECT
E	V-
F	V-
G	GROUND (Note 2)

Notes:

1) Use 12 AWG wire to each of the appropriate pins, according to the individual pin assignments.

2) As an alternative, the ground connection can be made to the unit's external ground stud.

2.3.5 Connector 'J6 | COM1' (Remote Communications and Discrete Control Port)

The **'J6 | COM 1'** discrete control connector is the primary input for controlling and monitoring the LPOD. It is a 19-pin circular connector, type MS3112E14-19S. The pinout specification is contained in **Table 2-8**.

Mating connector: ITT: KPT06J14-19P or MS3116J14-19P.

PS 1/PS 1.5   **PS 2**

Table 2-8. LPOD 'J6 | COM1' Pin Assignments

Pin	Name	Description
A	RS485_+RX	
B	RS485_-RX	
C	RS485_+TX	
D	RS485_-TX	
E	RS232_RD	Pin 3 of DB9 female connector
F	Ethernet TX+	Pin 3 of RJ45 female connector
G	RS232_TD	Pin 2 of DB9 female connector
H	Ethernet TX-	Pin 6 of RJ45 female connector
J	TX/RX Switch Drive 1 Pos	Not for customer use
K	GND	Ground (also Pin 5 of DB-9F connector)
L	SUMFLT In	Open when faulted, else +5VDC
M	SUMFLT Out	When faulted, tied to Pin K, else open
N	TX Switch Pos 1 Ind	Online/Offline indication
P	RX Switch Pos 1 Ind	Not for customer use
R	+24V	Not for customer use
S	System Mute Control	When **AUX=1**, unit is muted until this pin is tied to ground (Pin K). When tied to ground, the unit unmutes. See the AUX remote command in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT.**
T	Switch Common	GND reference for Pin N
U	Ethernet RX-	Pin 2 of RJ45 female connector
V	Ethernet RX+	Pin 1 of RJ45 female connector

2.3.6 Connector 'J9 | OUTPUT SAMPLE' (PS 2 Only)

The **'J9 | OUTPUT SAMPLE'** port is a Type 'N' female connector available only on the PS 2 model. It provides a nominal -40 dB sample of the output signal. A calibration label is provided near the connector that shows the actual coupling values vs. frequency.

2.3.7 Connectors 'J10 | MODEM Rx' and 'J11 | LNB' (Optional Interfaces)
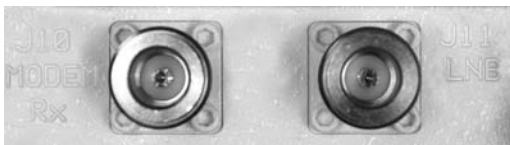
PS 1 / PS 1.5 – J10 (left), J11 (right)

The **'J10 | MODEM Rx'** and **'J11 | LNB'** ports are both Type 'N' female connectors, providing both bias and a reference signal to a Low Noise Block Converter (LNB), and passing the LNB's L-Band output to the modem's Rx input.
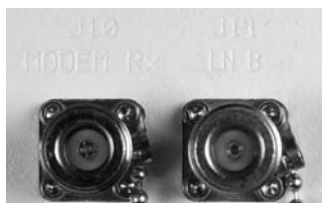
PS 2 – J10 (left), J11 (right)

2.3.8 Ground Connector

A #10-32 stud is provided at the locations shown in **Figure 2-6** for connecting a common chassis ground among equipment.
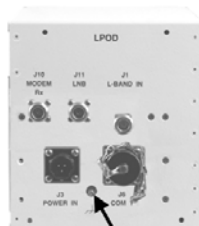
Figure 2-6. LPOD Ground Connectors

2.4   Standalone Installation of the LPOD

Several kits are available from Comtech EF Data to mount and install Standalone or 1:1
Redundancy LPODs, depending on the type of unit ordered and its operational frequency.
Refer to **Appendix A. 1:1 REDUNDANCY** for the available assembly kit options for 1:1 LPOD
redundancy configurations.

Figures on the pages that follow illustrate available Standalone mounting kits:

FIGURE	CEFD PART NO.	DESCRIPTION
2-5	PL/12319-1	Universal Pole Mounting Kit
2-6	KT-0000095	LPOD PS 1/PS 1.5 Single Unit Mounting Kit
2-7	KT-0000125	LPOD PS 2 Single Unit Mounting Kit
2-8	KT-0020524	LPOD-PS2 Single Unit Shelf Style Mounting Kit

Refer to **Appendix B. CABLE DRAWINGS** for information pertaining to the cables that are
available for use with the LPOD in Standalone or 1:1 Redundancy operation.

2.5   Power-up the LPOD

> ⚠️ **WARNING! NEVER TURN THE UNIT ON WITHOUT PROPER WAVEGUIDE
> TERMINATION ON THE 'J2 | RF OUT' PORT. INDIVIDUALS CAN BE EXPOSED TO
> DANGEROUSLY HIGH ELECTROMAGNETIC LEVELS.**

The LPOD does not have a 'Power On/Off' switch. It is powered ON by connecting the **'J3 |
POWER IN'** connector to the appropriate prime power source. The Mute or Transmit status of
the SSPA automatically comes up in the last stored state (factory default = Transmit on, not
muted).
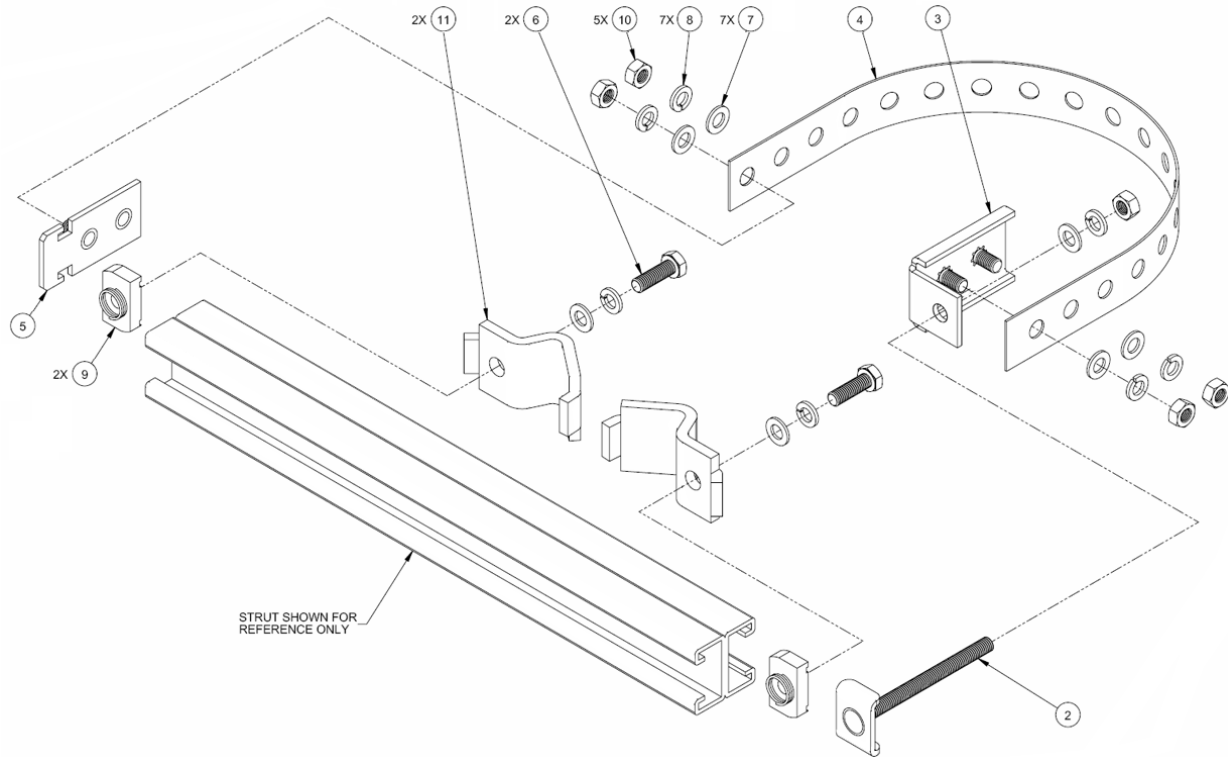
ⓘ **This kit accommodates a pole diameter (OD) of up to 13.00" (33.02 cm) maximum.**

		PL/12319-1 Universal Pole Mounting Kit	
ITEM	QTY	CEFD PART NO.	DESCRIPTION
1	1	N/A	BRACKET, UNISTRUT (SHOWN FOR CLARITY ONLY, INCLUDED IN CEFD P/N FP/BR0078 BRACKET MODIFICATION POLE MOUNTING KIT)
2	1	FP/BR0072	BRACKET, STRAP TENSIONER
3	1	FP/BR0070	BRACKET, STRAP-TERMINATION POLE MOUNTING KIT
4	1	FP/BR0071	BRACKET, 1-1/4 STRAP (TRIM LENGTH AS REQUIRED)
5	1	FP/BR0069	BRACKET, STRAP-FIXED, POLE MOUNTING KIT
6	2	HW/M8X1.25X25HEXSS	BOLT, HEXHEAD, M8X1.25X25, SS
7	7	HW/M8FLATSS	WASHER, FLAT, M8 SS, METRIC
8	7	HW/M8LOCKSS	LOCK WASHER, SPLIT, M8, SS, METRIC
9	2	HW/M8SPRINGNUT	SPRINGNUT, M8X1.25
10	5	HW/M8X1.25MMHEXNUTSS	NUT, HEX M8X1.25X16MM, SS
11	2	HW/BLK-PIPE2-8	PIPE, BLOCK

Figure 2-7. PL/12319-1 Universal Pole Mounting Kit
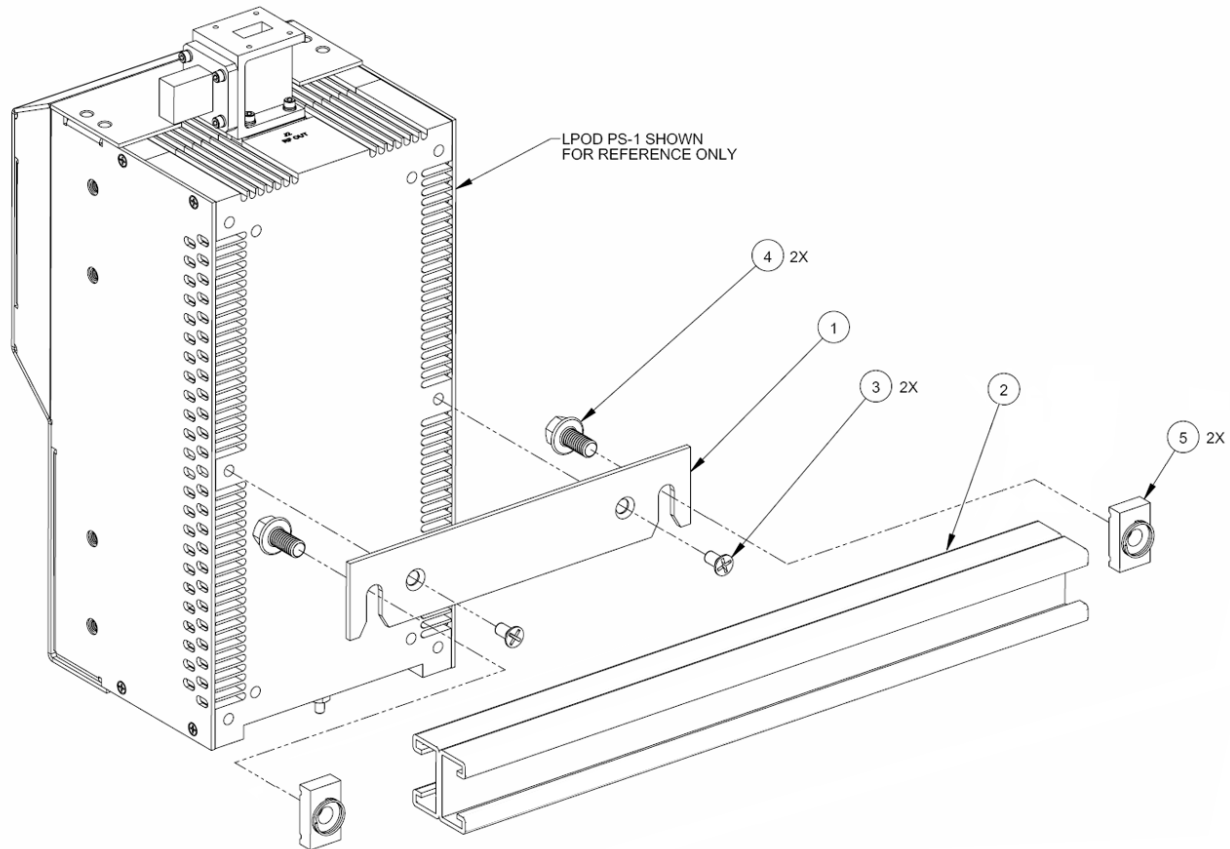
LPOD PS-1 SHOWN
FOR REFERENCE ONLY

KT-0000095 LPOD PS 1/PS 1.5 Single Unit Mounting Kit			
ITEM	QTY	CEFD PART NO.	DESCRIPTION
1	1	FP-0000534	BRACKET, MOUNTING
2	1	FP/BR0078	BRACKET MODIFICATION POLE MOUNTING KIT
3	2	HW/1/4-20X1/2FH	SCREW, 1/4-20 X 1/2 FH PHIL, 82, UCUT, SS
4	2	HW-0000070	SCREW, HEX, SERR FLANGE HD, 3/8-16 x 3/4, SS
5	2	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)

Figure 2-8. KT-0000095 LPOD PS 1/PS 1.5 Single Unit Mounting Kit
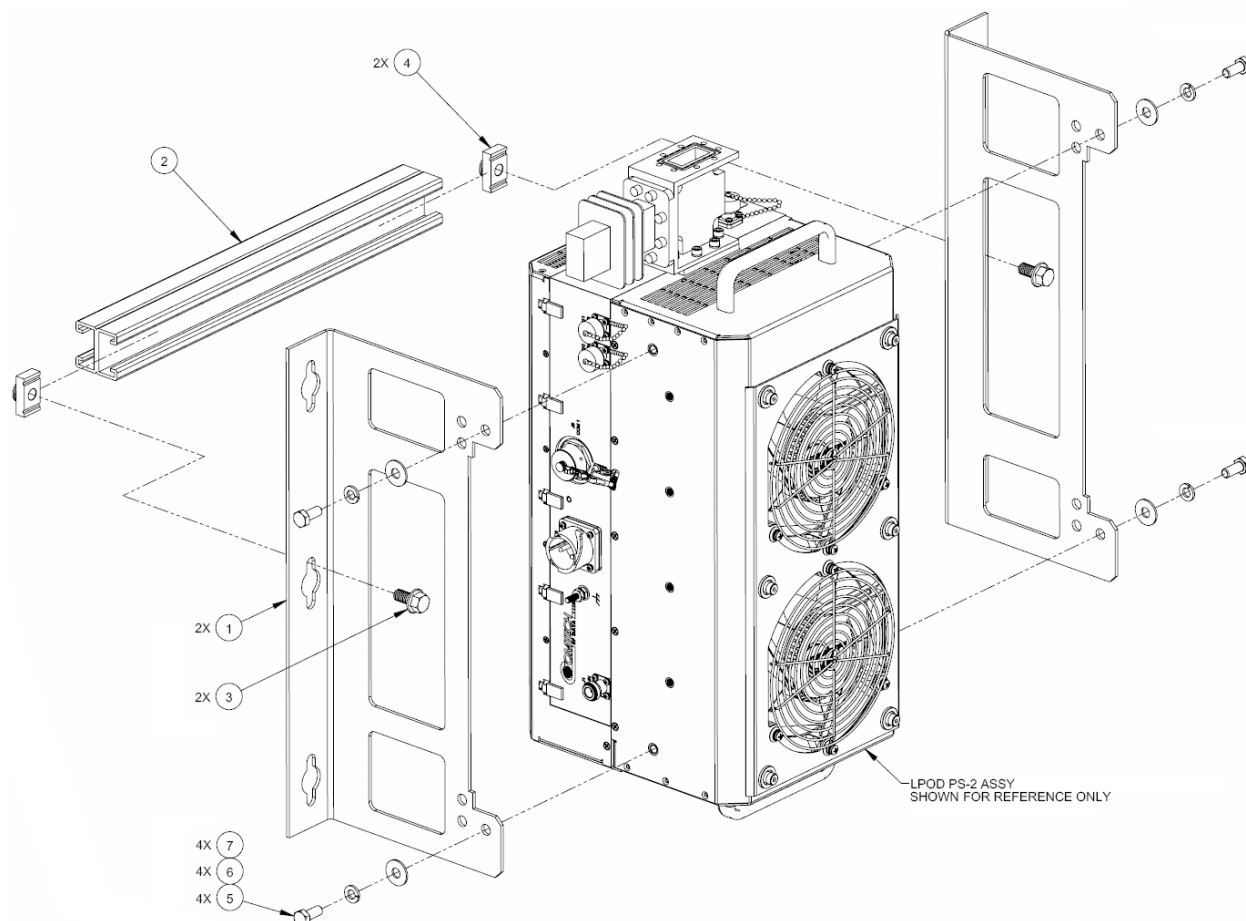
KT-0000125 LPOD PS 2 Single Unit Mounting Kit			
ITEM	QTY	CEFD PART NO.	DESCRIPTION
1	2	FP-0000677	BRACKET, MOUNTING, SS
2	1	FP/BR0078	BRACKET MODIFICATION POLE MOUNTING KIT
3	2	HW-0000070	SCREW, HEX, SERR FLANGE HEAD, 3/8-16 x 3/4, S.S
4	2	HW/3/8SPRINGNUT	SPRING NUT, 3/8-16, SHORT SPRING, SS (P3300)
5	4	HW/5/16-18X3/4B	BOLT, HEX HEAD, 5/16-18 X 3/4, SS
6	4	HW/5/16-SPLIT	LOCK WASHER, SPLIT, 5/16
7	4	HW/5/16-FLT	WASHER, FLAT, 5/16

Figure 2-9. KT-0000125 LPOD PS 2 Single Unit Mounting Kit
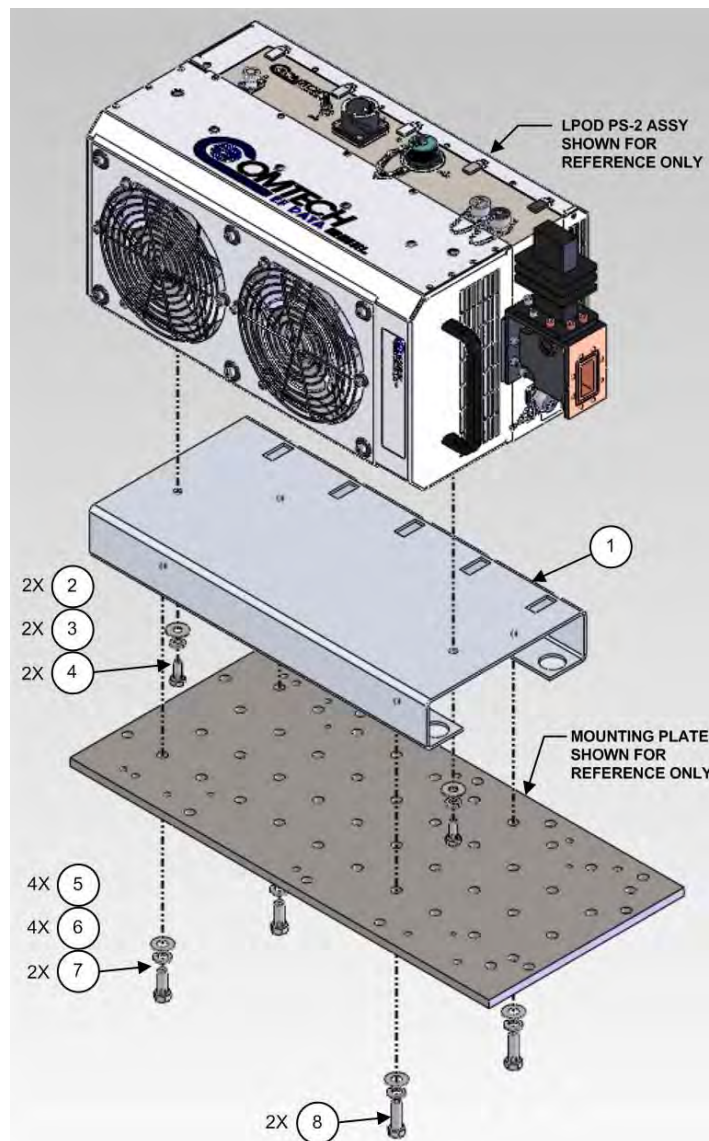
KT-0020524 LPOD PS 2 Single Unit Shelf Style Mounting Kit			
ITEM	QTY	CEFD PART NO.	DESCRIPTION
1	1	FP-0020545	BRACKET, MOUNTING
2	2	HW/5/16-FLT	FLAT WASHER, 5/16
3	2	HW/5/16-SPLIT	LOCK WASHER, SPLIT 5/16
4	2	HW/5/16-18X3/4B	BOLT, HEX HEAD, 5/16-18 X 3/4 LG
5	4	HW/3/8-FLT	FLAT WASHER, 3/8
6	4	HW/3/8-SPLIT	LOCK WASHER, SPLIT 3/8
7	2	HW/3/8-16X1B	BOLT, HEX HEAD, 3/8-16 X 1 LG
8	2	HW/3/8-16X1.25B	BOLT, HEX HEAD, 3/8-18 X 1.25 LG

Figure 2-10. KT-0020524 LPOD PS 2 Single Unit Shelf Style Mounting Ki

Chapter 3. UPDATING FIRMWARE

3.1   Overview

Comtech EF Data's LPOD family of Outdoor Amplifiers / Block Up Converters (BUCs) are factory-shipped with the latest version of operating firmware. Firmware updates may be applied to an LPOD system without having to remove it from operation. If you need to update the product firmware, you may download the update from the Comtech EF Data Web site (www.comtechefdata.com). You may also receive the firmware update archive file via e-mail from Comtech EF Data Product Support.

The LPOD Firmware Update process is as follows:

- Download the firmware update archive file via the Internet to a user-supplied Microsoft Windows®-compatible PC such as Comtech EF Data's optional LPOD*net* (right). The LPOD*net* is also used for Ethernet-based Remote Product Management/Monitor and Control (M&C),

- Use Comtech EF Data's optional CLC-10 Handheld Terminal M&C Accessory Kit (CEFD Kit KT-0020518) (right) for serial-based Remote Product Management/M&C.

  Alternately, use an adapter cable to directly connect the LPOD to the serial port of a user-supplied Microsoft Windows®-compatible PC such as the LPOD*net*.

- Extract the firmware update files from the archive download file, and then transfer the files from the User PC to the LPOD via File Transfer Protocol (FTP).

3.2   Getting Started: Prepare for the Firmware Download

1) First, identify the firmware number and its version number.

A. User-supplied items needed:

- A Microsoft Windows-based PC equipped with available serial and Ethernet ports, a compatible Web browser (e.g., Internet Explorer), and a terminal emulator program (e.g., Tera Term or HyperTerminal) if needed. Optionally, Comtech EF Data's optional LPOD*net* (part of M&C Netbook Accessory Kit CEFD Kit KT-0000203).

  o Your Ethernet connection may use either the CAT5 Ethernet adapter cable (CEFD P/N CA-0000352) to directly connect the User PC Ethernet port to the LPOD, or the optional LPOD*net* M&C Netbook Accessory Kit (CEFD Kit KT-0000203). The following example depicts use of the LPOD*net* for 1:1 Redundant or Standalone Ethernet connection:
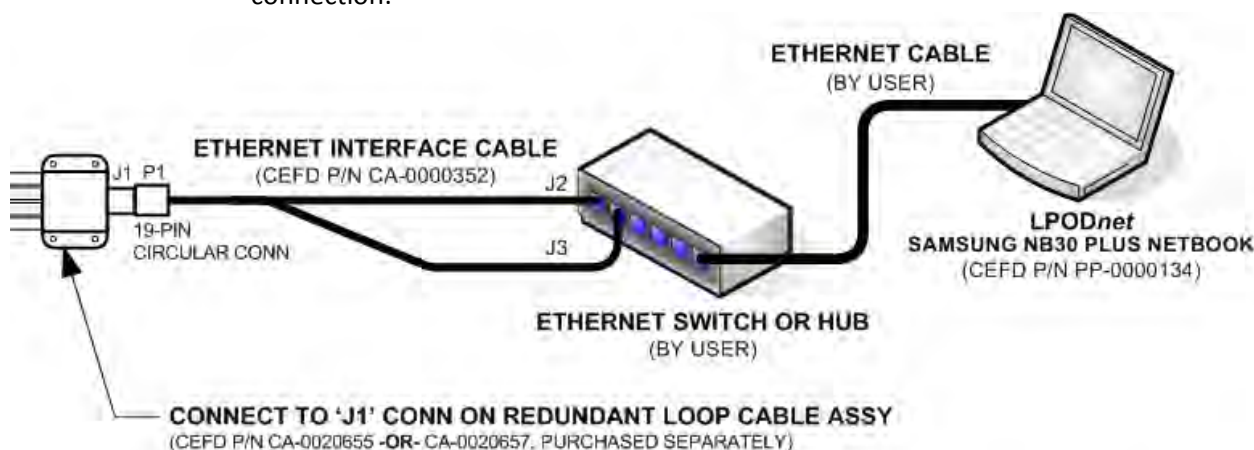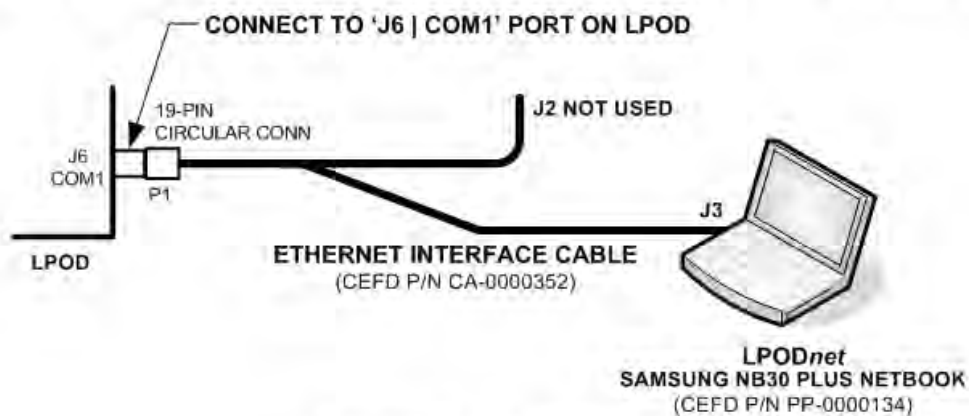
    o   Your serial connection may use either an user-fabricated adapter cable to connect the User PC serial port to the LPOD, or the optional CLC-10 Handheld Terminal (part of M&C Accessory Kit (CEFD Kit KT-0020518). The following example depicts use of the CLC-10 for 1:1 Redundant or Standalone serial connection:

TECHTERM HANDHELD TERMINAL
(CEFD P/N PP-0020518)

SERIAL INTERFACE CABLE
(CEFD P/N CA-0020526)

J1

19-PIN CIRCULAR CONN

RJ-11 6-WIRE CONN

CONNECT TO 'J1' CONN ON REDUNDANT LOOP CABLE ASSY
(CEFD P/N CA-0020655 -OR- CA-0020657, PURCHASED SEPARATELY)

1:1 REDUNDANCY APPLICATIONS

TECHTERM HANDHELD TERMINAL
(CEFD P/N PP-0020518)

SERIAL INTERFACE CABLE
(CEFD P/N CA-0020526)

J6 COM1

19-PIN CIRCULAR CONN

RJ-11 6-WIRE CONN

LPOD

CONNECT TO 'J6 | COM1' PORT ON LPOD
(PURCHASED SEPARATELY)

STANDALONE APPLICATIONS

B. On the User PC – If not using the CLC-10, configure the terminal emulator program if applicable.

> **Refer to your terminal emulator program HELP feature or user guide for operating and configuration instructions.**

Configure the utility program serial port communication and terminal display operation:

• **38400 bps (Baud Rate)**	• **8 Data Bits**	• **1 Stop Bit**
• **Parity = NO**	• **Port Flow Control = NONE**	• **Display New line Rx/Tx: CR**
• **Local Echo = ON**		

C. On the LPOD – Power up the unit. Your power connection varies depending on your ordered unit.

> **See Sect. 2.2.3 Connector 'J3 | POWER IN' (AC Power Mains) or Sect. 2.2.4 Connector 'J3 | POWER IN' (DC Power Mains) in this manual for your specific power connectors.**

D.　**Obtain the firmware information via one of the following methods:**

- **If using serial remote control, you may use the terminal emulator program or the CLC-10 to execute remote commands and queries with the LPOD. The firmware revision levels can be obtained with the following remote queries:**

  o　Abbreviated: **<0/SWR?** (returns basic Boot, Bulk1 and Bulk2 information)
  　　　　　　　　　　　　　　　　or
  o　Detailed: **<0/FRW?** (returns complete Boot, Bulk1 and Bulk2 information)

  See Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for more information on using remote commands/queries.

- **If using the Web Server Interface, the Bootrom, Image1 and Image2 firmware loads may be viewed using the Firmware Information section of the 'Config | Utility' page, or the 'Status | Status' page.**
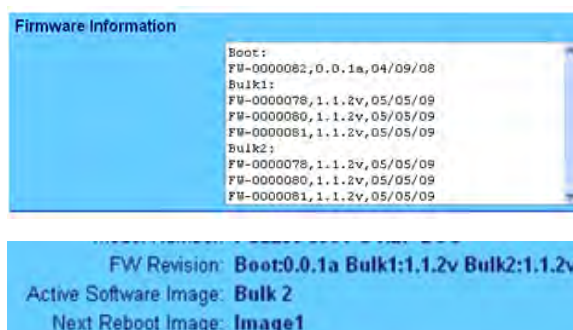
  See Chapter 4. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT for more information on using the LPOD Web Server Interface

2)　**Next, create a temporary folder (subdirectory) on the user PC for the firmware archive download.**

- **Drive letter 'c:' is used in these examples. Any valid, writable drive letter can be used.**

- **Typical for all tasks: Type the command <u>without quotes</u>, and then press Enter to execute.**

There are several ways you may use create a temporary folder on a Windows-based PC:

A.　**Use the Windows Desktop to create and rename the temporary folder.**

- Right-click anywhere on the desktop to open the popup submenu, and then select **New > Folder** to create the new, temporary folder on the desktop.

- Right-click on the new folder and then select '**Rename**' from the popup submenu. Rename this folder to "**temp**" or some other convenient, unused name.
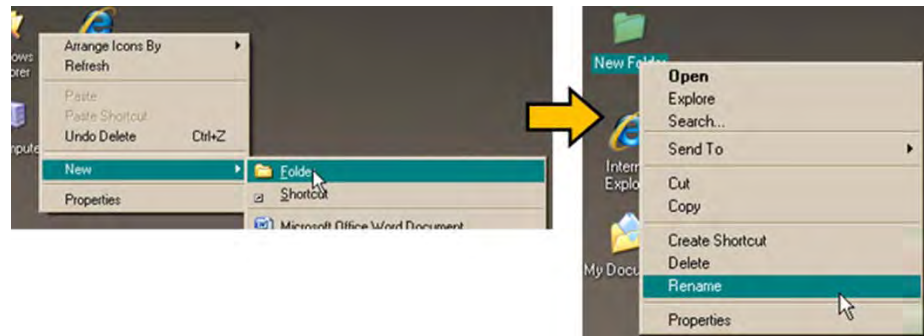
B. Use Windows Explorer to create and rename the temporary folder.

- Select **File > New > Folder** to create the new, temporary folder in the active location.

- Right-click the '**New Folder**' folder name, and then rename this folder to "**temp**" or some other convenient, unused name.

C. Use the 'Run' and 'Browse' windows to create and rename the temporary folder.

- Select **[Start]** on the Windows taskbar and then click the **Run...** icon. The '**Run**' window will open.

- Click **[Browse]** in the '**Run**' window. The '**Browse**' window will open.

- Click the **Create New Folder** icon in the '**Browse**' window to create the new folder in the active location.

- Right-click the '**New Folder**' folder name, and then rename this folder to "**temp**" or some other convenient, unused name.
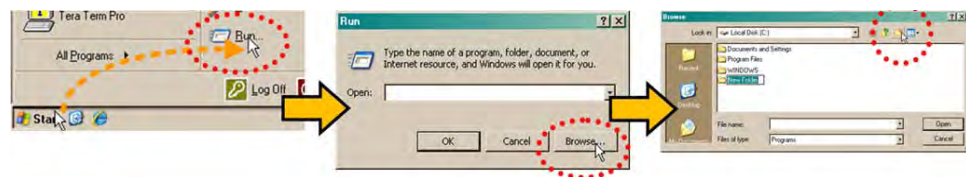
D. Use Windows Command-line to create the temporary folder.

- **First,** click **[Start]** on the Windows taskbar, and then click the '**Run...**' icon (or, depending on Windows OS versions prior to Windows 95, click the '**MS-DOS Prompt**' icon from the Main Menu).

- **Next,** open a **Command-line** window…

  o For Windows 95 or Windows 98 – Type "**command**".

  o For any Windows OS versions later than Windows 98 – Type "**cmd**" or "**command**".
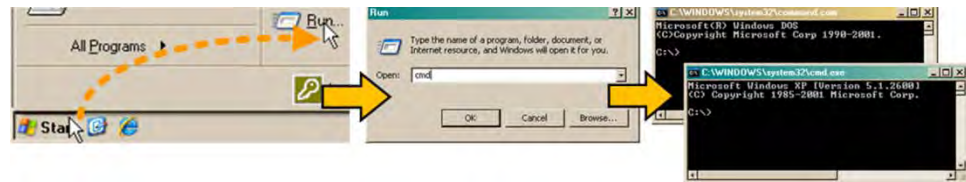
  o Alternately, from **[Start]**, select **All Programs > Accessories > Command Prompt**.

  o Finally, from the Command-line '**c:\>**' prompt, type "**mkdir temp**" or "**md temp**" (mkdir and md stand for make directory), and then click **[OK]**.
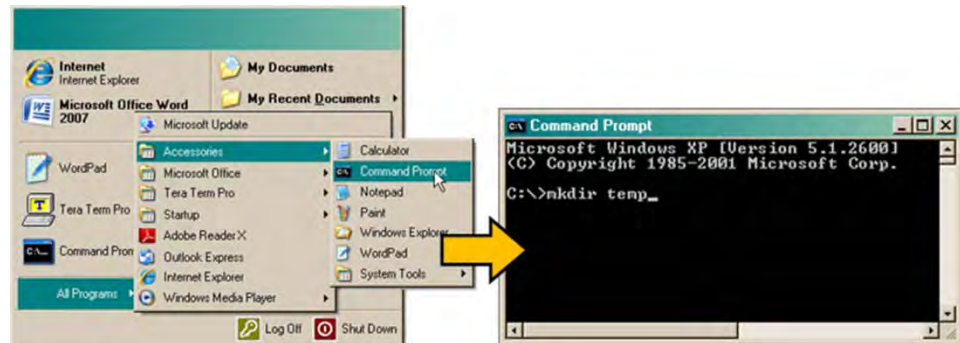
There should now be a 'temp' folder created and available for placement of the firmware file download.

3.3   Download and Extract the Firmware Update

1)   First, download the firmware update file from the Comtech EF Data Web site:

A.   Go online to www.comtechefdata.com.

B.   On the Main page – Under **Support Information** or the **Support** tab, select the **Software Downloads** hyperlink.

C.   On the Software Downloads page – Click **Download Flash and Software Update Files**.

D.   On the Flash Updates Index page – Select the **(Select a Product Line) Amplifiers** hyperlink.

E.   On the Amplifiers product page – Select the **LPOD** product hyperlink;

F.   Select the appropriate firmware archive EXE or ZIP file download hyperlink.

> - **About Firmware Numbers, File Versions, and Formats:** The Comtech EF Data Web site catalogues its firmware update files by product type (e.g., router, modem, etc.), the specific model, and optional hardware configurations.
>
>   The LPOD firmware download hyperlink appears as **F0000078X_V###**, where '**X**' denotes the revision letter, and '**###**' represents the firmware version number (e.g., V151 = Version 1.5.1).
>
> - **About File Archive Formats:** Comtech EF Data provides its downloadable files in two compressed archive formats: ***.exe** (self-extracting) and ***.zip** (compressed).
>
>   The ***.exe** file does not require a file archiver and compression utility program such as PKZIP for Windows, WinZip, ZipCentral, etc. (PKZIP for DOS is not supported due to file naming conventions). **Comtech EF Data does not provide this utility program.**
>
>   Some firewalls do not allow the download of *.exe files. Download the *.zip file instead, and extract the firmware files from the archive download with a user-supplied utility program. For detailed information on handling archived files, refer to the utility program Help documentation.

G.   Download the archive file to the temporary folder.

- Once the **EXE** or **ZIP** hyperlink is selected the '**File Download'** window opens and prompts selection of **[Open]** or **[Save]**:

       o   Click **[Open]** to turn over file extraction to the user-supplied utility program. Be sure to extract the firmware files to the '**temp**' folder created earlier.

       o   Click **[Save]** to open the '**Save As'** window. Be sure to select and **[Save]** the archive ***.exe** or ***.zip** file to the '**temp**' folder created earlier.

          Otherwise, click **[Cancel]** to quit and exit the file download process.

2) **Next, extract the firmware files from the archive file.**

- (If not already done with **File Download > [Open]**) Extract the firmware files from the downloaded ***.exe** or ***.zip** archive file with the user-supplied utility program:

     o   Double-click on the archive file name, and then follow the prompts provided by the user-supplied utility program. Extract, at a minimum, two files:

         ▪ **FW-0000078x_LPOD_#_#_#.bin** – The Firmware Bulk image file (where 'x' denotes the revision letter and '#_#_#' denotes the firmware version number), and

         ▪ **ReleaseNotes_LPOD-PSx_v#-#-#.pdf** – The Firmware Release Notes PDF file (where '#-#-#' denotes the firmware version number).

3) **Confirm availability of the firmware files in the temporary folder.**

There are several ways you may view the contents of the temporary folder on a Windows-based PC:

A. **From the Windows Desktop:**

- Double-left-click the '**temp'** folder saved to the Windows Desktop.

- Use **Windows Explorer** to locate, and then double-left-click the '**temp**' folder.

- Use the '**Browse'** window (**[Start] > ...Run > [Browse]**) to locate, and then double-click the '**c:\temp**' folder.

B. **Using Command-line:**

- Type "**cd c:\temp**" at the Command-line prompt to change to the temporary directory created earlier using Command-line.

- Type "**dir**" to list the files extracted to the temporary directory from the downloaded archive file.

The firmware files have been successfully downloaded and are now available for transfer to the LPOD.

3.4   Perform the FTP Upload Procedure

To proceed with the firmware update procedure, assumptions are made that:

- **The LPOD is connected to a user-supplied, Windows-based PC, and:**

  o **The User PC serial port is connected to the LPOD's 'J6 |COM1' port using the appropriate adaptive cabling,**
  – OR –
  o **The User PC Ethernet port is connected to the LPOD's 'J6 |COM1' port with a user-supplied hub, switch, or a direct adaptive Ethernet cable connection.**

  o **The User PC is running a terminal emulation program (for operation of the LPOD Serial or Telnet interfaces) and a compatible Web browser (for operation of the LPOD Web Server Interface).**

- **The latest firmware files have been downloaded or otherwise received from Comtech EF Data and are available on the user PC in an accessible temporary folder.**

1) **Use Command-Line to send a 'PING' command to confirm proper connection and communication between the user PC and the LPOD:**

- **Obtain the IP Address** of the unit using serial remote control or the LPOD Web Server Interface:

  o **Using Serial Remote Control** – Type the "**<0/IPA?"** remote query (without quotes) at the command prompt. The unit returns the configured IP Address.

  o **Using the LPOD Web Server Interface** – View the entry for IP Address/Range in the **Network Maintenance** section of the '**Admin | Access**' page:

- **Once the IP Address is known – use Command-line to PING:** Type "**ping xxx.xxx.xxx.xxx**" at the Command-line prompt (where '**xxx.xxx.xxx.xxx**' is the unit IP Address).

The response should confirm whether the unit is properly connected and communicating.

2) **Use Command-line to transfer (FTP) the files from the user PC to the LPOD:**

- Type "**ftp xxx.xxx.xxx.xxx**" (where 'xxx.xxx.xxx.xxx' denotes the unit IP Address).

- Type "**bin**" to set the binary transfer mode.

- Type "**prompt**" and then type "**hash**" to facilitate the file transfers.

- Type "**put FW-0000078x.bin bulk:**" (where '**x**' denotes the firmware revision letter) at the Command-line prompt, without quotes, to begin the file transfer. The destination "**bulk:**" must be all lower-case.

    Wait while the file transfers.

- Type "**bye**" to terminate the FTP session, and then close the Command-line window.

3) To verify that the User PC-to-Unit FTP file transfer was successful, review the current firmware information via the serial or Ethernet interfaces (see **Sect. 3.2, Step 1D**).

4) Use the LPOD Web Server Interface to select the firmware and soft-reboot the unit:

   A. **Select the desired Active Firmware Image:**

   - **Using the LPOD Web Server Interface** – Use the **Next Reboot Image** drop-down list on the '**Config | Utility**' page to select Image **1** or **2**, and then click **[Submit]**.

Current Active Firmware Image : 1   Next Reboot Image : 1 ▾ Submit

   B. **Soft-reboot the LPOD:**

   - **Using the LPOD Web Server Interface** – Click **[Reboot Now]** in the **Perform Soft Reboot** section of the '**Config | Utility**' page to reboot the LPOD using the Current Active Firmware Image.

Perform Soft Reboot   Reboot Now

   - Wait while the LPOD reboots.

5) To load the second image, repeat **Step 4**.

6) Once the unit has rebooted (after switching to the new firmware), type the "**<0/CTD=1?**" remote command (without quotes) at the command prompt to clear the trending data.

The LPOD is now operating with its latest firmware. The firmware update process is now complete.

Chapter 4. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

4.1 Overview

Ethernet-based remote management and control of the LPOD is available when the appropriate adapter cable, connected to the LPOD '**J6 | COM1**' 19-pin communications port.

1) **TO PROCEED WITH ETHERNET-BASED REMOTE PRODUCT MANAGEMENT, ASSUMPTIONS ARE MADE THAT:**

- **The LPOD is operating with the latest version firmware files.**

- **The LPOD is connected to a user-supplied Windows-based PC as follows:**

  o **The PC's Ethernet port is connected to the LPOD 'J6 | COM1' port using the available CA-0000352 Ethernet Interface Cable (part of CEFD Kit KT-0000203) in combination with a user-supplied hub or switch.**

  o **The PC is running a terminal emulation program (for operation of the LPOD Telnet Interface) and a compatible web browser (for operation of the LPOD Web Server Interface).**

- **The LPOD's Management IP Address has been noted.**

2) **USE OF THE ETHERNET-BASED SNMP INTERFACE IS RECOMMENDED ONLY FOR ADVANCED USERS. ALL OTHER USERS ARE STRONGLY ENCOURAGED TO USE THE LPOD WEB SERVER INTERFACE FOR REMOTE MONITOR AND CONTROL (M&C) OF THE LPOD.**

4.2   Ethernet Management Interface Protocols

The user PC facilitates access to Ethernet-based remote monitor and control (M&C) of the LPOD 100BaseT/10BaseTx Ethernet Management Interface through three separately operated protocols:

- **Simple Network Management Protocol (SNMP).** This requires a user-supplied Network Management System (NMS) and a user-supplied Management Information Base (MIB) File Browser.

- **Telnet Interface.** This requires use of the user PC's Command-line interface, or a user-supplied terminal emulation program such as HyperTerminal.

- **Web Server (HTTP) Interface.** This requires a compatible user-supplied web browser such as Internet Explorer.

4.3   SNMP Interface

The *Simple Network Management Protocol* (SNMP) is an Internet-standard protocol for managing devices on IP networks. An SNMP-managed network consists of three key components:

- **The managed device.** This includes the LPOD.

- **The SNMP Agent.** The software that runs on the LPOD. The LPOD SNMP Agent supports both **SNMPv1** and **SNMPv2c**.

- **The user-supplied Network Management System (NMS).** The software that runs on the manager.

4.3.1 Management Information Base (MIB) Files

An MIB file is used for SNMP remote management of a unique device, and consist of a tree of nodes called Object Identifiers (OIDs). Each OID provides remote management of a particular function. These MIB files should be compiled in a user-supplied MIB Browser or SNMP Network Monitoring System server.

The following MIB files are associated with the LPOD:

MIB File/Name (where 'x' is revision letter)	Description

FW-0000291x.mib ComtechEFData Root MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech EF Data LPOD products (PSx) and consists of only the following OID:
	    Name: comtechEFData
	    Type: MODULE-IDENTITY
	    OID: 1.3.6.1.4.1.6247
	    Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247)
	    Module: ComtechEFData

MIB File/Name (where 'x' is revision letter)	Description
FW-0000289x.mib LPOD MIB file	MIB file consists of all of the OID's for management of the LPOD functions
FW-0000290x.mib LPOD Traps MIB file	Trap MIB file provides SNMPv1 traps common for LPOD.

4.3.2 SNMP Community Strings

In SNMP v1/v2c, the SNMP Community String is sent unencrypted in the SNMP packets. Caution must be taken by the network administrator to ensure that SNMP packets travel only over a secure and private network if security is a concern.

The LPOD uses Community Strings as a password scheme that provides authentication before gaining access to the router agent's MIBs. They are used to authenticate users and determine access privileges to the SNMP agent. The LPOD defines three Community Strings for SNMP access:

- **Read Community**   default = public

- **Write Community**   default = private

- **Trap Community**   default = comtech

Type the SNMP Community String into the user-supplied MIB Browser or Network Node ` Management software.

For proper SNMP operation, the LPOD MIB files must be used with the associated version of the LPOD M&C. Please refer to the LPOD FW Release Notes for information on the required FW/SW compatibility.

4.3.3 SNMP Traps

The LPOD has the ability to send out SNMP traps both when a fault occurs and when a fault clears in the unit. The SNMP agent supports both "**SNMPv1**" and "**v2c**". The "**Traps**" file only needs to be compiled if "**SNMPv1**" traps are to be used.

You may configure which style of traps the LPOD sends by using the lpodSNMPTrapVersion OID.

The LPOD supports the following MIB2 v1traps and v2 notifications:

MIB2 SNMPv1 trap: Authentication Failure	5
MIB2 SNMPv2 notifications: Authentication Failure	1.3.6.1.6.3.1.1.5.5

The LPOD supports the following Faults v1 traps and v2 notifications:

Faults SNMPv1 traps:	
IpodPowerSupply24V1StatusV1	62474801
IpodPowerSupply24V2StatusV1	62474802
IpodPowerSupplyLNBStatusV1	62474803
IpodPowerSupply13VStatusV1	62474804
IpodPowerSupply10VStatusV1	62474805
IpodRFPowerSupply10V1StatusV1	62474806
IpodRFPowerSupply10V2StatusV1	62474807
IpodPowerSupply7V8TStatusV1	62474808
IpodPowerSupply5V8TStatusV1	62474809
IpodPowerSupply2V5TStatusV1	62474810
IpodPowerSupply1V2TStatusV1	62474811
IpodPowerSupplyNeg5V8TStatusV1	62474812
IpodFan1StatusV1	62474813
IpodFan2StatusV1	62474814
IpodTemperatureStatusV1	62474815
IpodShutdownStatusV1	62474816
IpodI2CStatusV1	62474817
IpodForwardPowerStatusV1	62474818
IpodChecksumStatusV1	62474819
IpodFPGADoneStatusV1	62474820
IpodBUCLockDetectStatusV1	62474821
IpodRefLockDetectStatusV1	62474822
IpodLNBCSStatusV1	62474823
IpodSwitchStatusV1	62474824
Faults SNMPv2 notifications:	
IpodPowerSupply24V1Status	1.3.6.1.4.1.6247.48.1.3.1.1
IpodPowerSupply24V2Status	1.3.6.1.4.1.6247.48.1.3.1.2
IpodPowerSupplyLNBStatus	1.3.6.1.4.1.6247.48.1.3.1.3
IpodPowerSupply13VStatus	1.3.6.1.4.1.6247.48.1.3.1.4
IpodPowerSupply10VStatus	1.3.6.1.4.1.6247.48.1.3.1.5
IpodRFPowerSupply10V1Status	1.3.6.1.4.1.6247.48.1.3.1.6

IpodRFPowerSupply10V2Status	1.3.6.1.4.1.6247.48.1.3.1.7
IpodPowerSupply7V8TStatus	1.3.6.1.4.1.6247.48.1.3.1.8
IpodPowerSupply5V8TStatus	1.3.6.1.4.1.6247.48.1.3.1.9
IpodPowerSupply2V5TStatus	1.3.6.1.4.1.6247.48.1.3.1.10
IpodPowerSupply1V2TStatus	1.3.6.1.4.1.6247.48.1.3.1.11
IpodPowerSupplyNeg5V8TStatus	1.3.6.1.4.1.6247.48.1.3.1.12
IpodFan1Status	1.3.6.1.4.1.6247.48.1.3.1.13
IpodFan2Status	1.3.6.1.4.1.6247.48.1.3.1.14
IpodTemperatureStatus	1.3.6.1.4.1.6247.48.1.3.1.15
IpodShutdownStatus	1.3.6.1.4.1.6247.48.1.3.1.16
IpodI2CStatus	1.3.6.1.4.1.6247.48.1.3.1.17
IpodForwardPowerStatus	1.3.6.1.4.1.6247.48.1.3.1.18
IpodChecksumStatus	1.3.6.1.4.1.6247.48.1.3.1.19
IpodFPGADoneStatus	1.3.6.1.4.1.6247.48.1.3.1.20
IpodBUCLockDetectStatus	1.3.6.1.4.1.6247.48.1.3.1.21
IpodRefLockDetectStatus	1.3.6.1.4.1.6247.48.1.3.1.22
IpodLNBCSStatus	1.3.6.1.4.1.6247.48.1.3.1.23
IpodSwitchStatus	1.3.6.1.4.1.6247.48.1.3.1.24

4.4 Telnet Interface

The LPOD provides a Telnet interface for the purpose of equipment M&C via the standard Remote Control protocol. The Telnet interface requires user login at the **Administrator** level and **Read/Write** level. An example of the login process is shown here:

Once logged into the Telnet interface as the Administrator, you can access the standard remote control interface defined in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT**, as shown here:

4.4.1 Using HyperTerminal for Telnet Remote Control Operation

There is a disadvantage when using Windows Command-line as a Telnet client with the standard Remote Control protocol. Since Command-line cannot translate a '\r' (i.e., carriage return or "CR") to a '\r\n' (i.e., CR+line feed "LF") for the messages coming from Telnet Server, any multi-line Target-to-Controller response (e.g., the response to the FRW? query) will be displayed as one line, with the latter lines overwriting the previous lines.

In order to view the full response messages, use of the HyperTerminal terminal emulation program configured as a Telnet client is permissible.

Configure HyperTerminal as follows:

1) Be sure to properly define the "**Connect To"** Telnet connection properties (**File →
Properties**), as shown below at the near right:

- Enter the LPOD's
  Management IP Address as
  the **Host Address** (e.g.,
  192.168.1.1).

- Enter TCP Port **23** as the **Port
  number**.

- Set **Connect using** to **TCP/IP
  (Winsock)** instead of COM1
  or COM2.
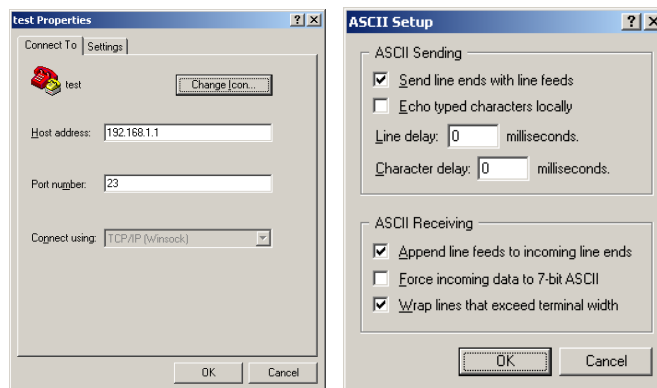
2) For **ASCII Setup** (**File → Properties → Settings → ASCII Setup**), as shown above at the far
right:

A. Check the "**Send line ends with line feeds**" option in the *ASCII Sending* section.

B. Check the "**Append line feeds to incoming line ends**" option in the *ASCII Receiving*
section.

An example of login and remote command/query execution, when using HyperTerminal as the
interface, appears as follows:

```
COMTECH EF DATA TELNET INTERFACE

You must have an account to use this interface.
Please see your administrator.

Enter name: comtech

Enter password: comtech

Name and Password accepted.   Please review your SSPA manual for command syntax.


<Q=Quit> Telnet--><1/LRS=3
>0001/LRS=

<Q=Quit> Telnet-->
```
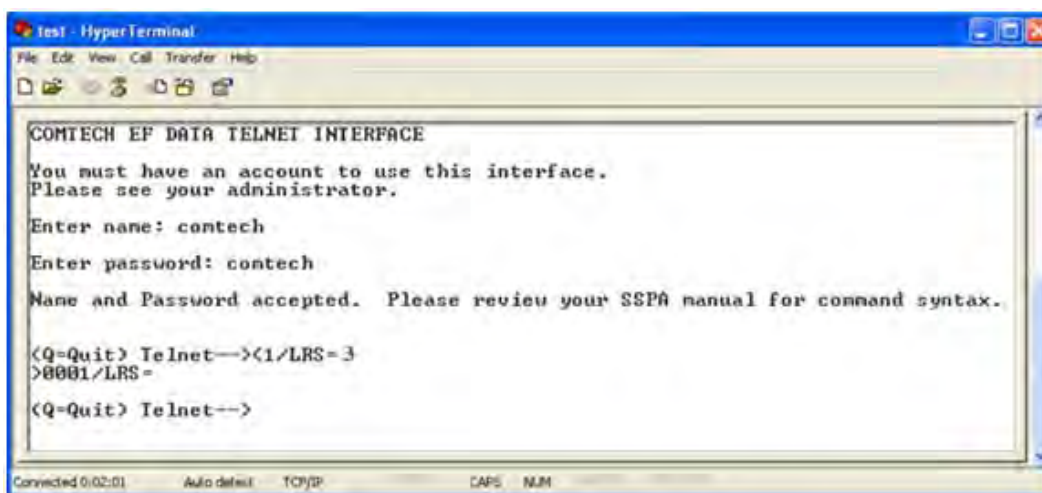
4.5   Web Server (HTTP) Interface

A user-supplied web browser allows the full monitor and control (M&C) of the LPOD through its Web Server Interface. This non-secure embedded web application is designed for, and works best with, Microsoft's Internet Explorer Version 5.5 or higher.

See the Remote Commands and Queries specifications tables found in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT** for detailed descriptions of many of the functions depicted throughout **Sect. 4.5.4 Web Server Page Descriptions**.

4.5.1 Enabling the Web Server Interface

To enable the Web Server Interface in the LPOD using only a 100BaseTx remote interface (this assumes that you are running a Microsoft Windows OS):

1) Select **Start**, then **Run**, then type "**cmd**" to open the command prompt window:
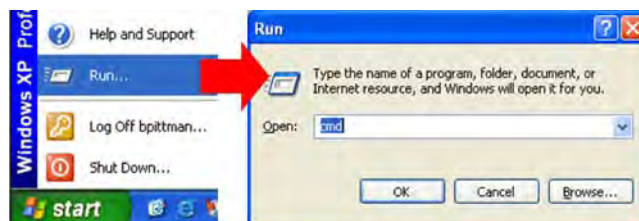
2) Start a Telnet session with the unit at the default IP address of **192.168.1.4**:
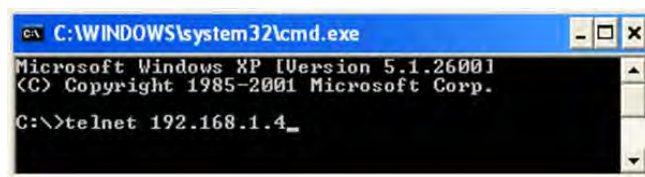
3) Enter the Telnet username and password (the default for both parameters is **comtech**):
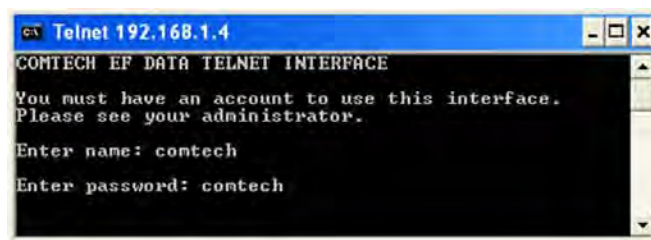
4) Set the remote access parameter to accept Ethernet remote control using the **LRS** command.

   LRS=3, the default remote command, provides **Serial + Ethernet control**, while remote command **LRS=2** provides **Ethernet control only**.

Note: You must assign a unique IP Address for each unit on the network before connecting to an existing network. As the IP address may need to be changed to something other than the factory default setting, use the command **IPA=xxx.xxx.xxx.xxx.yy**, where: **xxx.xxx.xxx.xxx** is a valid IP address on the network where the unit is to be installed, and **yy** is the range (typically, **yy** = 24).

Changing the **IPA** value requires that you cycle power on the unit, and then start a new Telnet session using the new IP address.

See **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT** for more information on the **LRS** and **IPA** commands.

4.5.2 User Login

1) From the PC, type **http://192.168.1.4** (the default IP address for the LPOD) into the **Address** area of the browser:
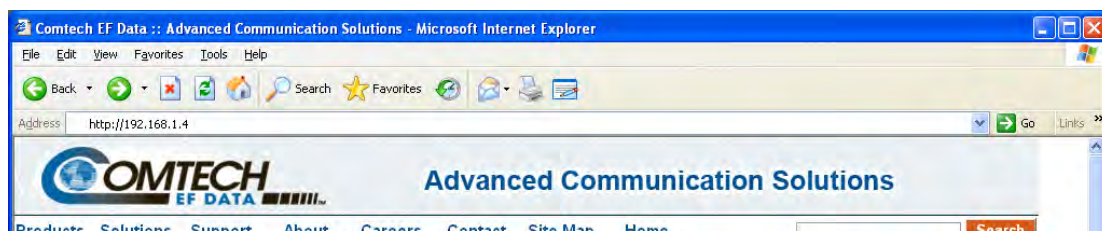
2) The Login window will appear, similar to the example shown here. Type the **User name** and **Password,** and then click **[OK]**. The default User Name and Password are both **comtech**.

Once the valid User Name and Password is accepted, the LPOD Web Server Interface "splash" page displays, as per the example shown to the right (note that the *Firmware Version* listed here is subject to change):

4.5.3 Web Server Interface – Operational Features

4.5.3.1   Menu Tree

This menu tree diagram lists the features available through the LPOD Web Server Interface. This
interface features four navigation tabs (shown in blue). The nested page hyperlinks (grey)
provide access to individual Web pages.

Home	Admin	Config	Status
Home	Access	Amplifier	Summary
Contact	SNMP	LNB	Status
Support		Utility	FETs
		Redundancy	Events
			Statistics
			Trending Graphs

4.5.3.2   Page Navigation

The Web Server Interface features four navigation tabs located at the
top of each page. After you click a navigation tab, you may click an
available page hyperlink.

This manual uses a naming format for all web pages to indicate to you the navigation needed to
view the referenced page: "**Navigation Tab | Page Hyperlink.**"

For example, interpret "**Home | Support**" to mean, "*first* click the '**Home**' navigation tab, and
then click the '**Support**' page hyperlink."

4.5.3.3   Page Sections

Each page features one or more sections. The title at the upper-left
corner of each page or page section describes its operational features.
Each section can feature editable fields, action buttons, and read-only
displays for a specific function.

This manual explains the purpose and operation for each Web page on a **per-page, per-section**
basis.

4.5.3.4   Action Buttons

Action buttons are important in the LPOD Web Server Interface. Click an
action button to do one of these tasks:
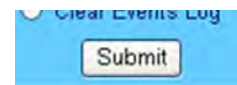
- Refresh the page with current data.

- Reset changed parameters to remove **unsaved** changes.

- Submit (permanently save) changes.

> **If you edit a field, make sure to click the action button before you leave the page.
> If you go to another page without first clicking the action button, your changes are
> <u>not</u> saved.**

4.5.3.5   Drop-down Lists

A drop-down list lets you choose from a list of selections. Left-click the
drop-down button to open the list. Then, left-click on an item to select that
choice.
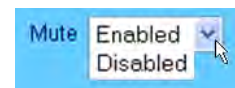
4.5.3.6   Text or Data Entry

Text boxes let you type data into a field. An action button may be
associated with a single text box, or a group of text boxes.

For any text box, left-click anywhere inside the box, type the desired information into that field,
and be sure to press **[ENTER]** when done.

Click the related action button to save the data.

> **If you edit any field, make sure to click the action button before you leave the
> page. If you go to another page without first clicking the action button, your
> changes are <u>not</u> saved.**

4.5.4 Web Server Interface – Web Page Descriptions

The LPOD Web Server Interface pages, as depicted in the figures featured through the end of this chapter, show operational examples that will vary from your actual implemented network. These figures are provided for reference purposes only.

4.5.4.1   Home Pages

Click the **Home** tab, and then click the **Home**, **Contact**, or **Support** hyperlink to continue.

4.5.4.1.1   Home | Home

Use this page to identify the LPOD Web Server Interface, the specific product, and its assigned serial number. Click the **Home** tab and/or the nested **Home** hyperlink to return to this page from anywhere in the Web Server Interface.

Figure 4-1. LPOD Home | Home Page

4.5.4.1.2   Home | Contact

Use this page to see the contact information (phone, fax, or Web/e-mail hyperlinks) for
Comtech EF Data Product Support.

Figure 4-2. Home | Contact Page

4.5.4.1.3   Home | Support

> ⓘ **For this page to operate correctly, the Administrator must define the SMTP server, domain name, and destination on the Admin | Access page (see Sect.4.5.4.2.1).**

This page uses SMTP (Simple Mail Transport Protocol) to compose and send an e-mail message to Comtech EF Data Product Customer (techsupport@comtechefdata.com). Use this communications portal for questions about or problems with the unit.

Figure 4-3. Home | Support Page

Contact Information

Provide your contact information – **Name**, **Company**, **Telephone,** and **E-mail** – to Comtech EF Data here.

Problem Report

Use this section to compose the required message of up to a maximum of 256 characters.

Provide your **Contact Information**; compose your message in the **Problem Report** box, and then click **[Submit Email]** to send the message.

4.5.4.2   Admin Pages

> **The Admin pages are available only to users who have logged in using the Administrator Name and Password.**

Click the **Admin** tab, and then select the **Access** or **SNMP** hyperlink to continue.

4.5.4.2.1   Admin | Access

The Administrator must use this page to manage the Web Server Interface user access settings.

Figure 4-4. Admin | Access Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current operating configuration.

Network Maintenance

- **IP Gateway, IP Address/Range:** Enter the desired IP Gateway Address and IP Address/ Range in these text boxes.

- **MAC Address** *(read-only)***:** The MAC is set at the factory to a guaranteed unique address that you cannot modify.

Click **[Change IP Address]** to save any changes. Otherwise, click **[Reset]** if you wish to revert to the previously assigned IP Gateway and IP Address/Range.

System Account Access Information

- **Admin, Read/Write, and Read Only Names and Passwords:**

  The factory defaults for these names/passwords are:

  o **Admin**   comtech/comtech

  o **Read/Write**   opcenter/1234

  o **Read Only**   monitor/1234

  Note the following:

  o These **Name** fields can be any alphanumeric combination with a maximum length of 10 characters.

  o These **Password** fields can be any alphanumeric combination with a maximum length of 10 characters.

- **SMTP Server:** Specify the mail server IP address from where you want to send the e-mail.

- **SMTP Domain Name / Destination:** The Administrator can assign the SMTP Domain Name and Destination. This is required if you wish to use the **Home | Support** page e-mail feature (**Sect.4.5.4.1.3**).

  o For **SMTP Domain Name**, specify the domain of the e-mail server (usually found to the right of the @ symbol in an e-mail address).

  o For **SMTP Domain Destination**, specify the e-mail recipient name (usually found to the left of the @ symbol in an e-mail address).

Click **[Change Access]** to save any changes. Otherwise, click **[Reset]** to revert to the previously assigned System Account Access Information.

Webpage Timeout

The Webpage Timeout determines a desired time lapse before the LPOD Web Server Interface pages time out. Use the drop-down list to select **five minutes** or **eight hours**. The default timeout setting is five minutes. Click **[Submit]** when done.

The 'Status | Status' page (Figure 4-11 in Sect. 4.5.4.4.2) automatically refreshes and resets the timeout counter once every ten seconds.

4.5.4.2.2   Admin | SNMP

Sect. 4.3 SNMP INTERFACE

The Administrator must use this page to manage the LPOD SNMP (Simple Network Management Protocol) settings.

Figure 4-5. Admin | SNMP Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current operating configuration.

SNMP

- **Simple Network Management** (Operational Status) – Use the drop-down list to select the Simple Network Management operational setting as **Enabled** or **Disabled**.

- The **Read Community String** and **Write Community String** fields can be any combination of characters and a length of 0 to 20 characters:

    o   The factory default for the **Read Community String** parameter is **public**.

    o   The factory default **Write Community String** is **private**.

- **Authentication Trap Operational Status** – Use the drop-down list to select the Enable Authentication Trap operational setting as **Enabled** or **Disabled**.

- The Administrator can assign up to two **SNMP Trap IP** addresses and one **SNMP Trap Community String.**

- The **SNMP Trap Community String** field can be any combination of characters and a length of 0 to 20 characters. The factory default for the **SNMP Trap Community String** is **comtech**.

Click [**Submit SNMP**] to save any changes. Otherwise, click **[Reset]** to revert to the previously
assigned SNMP designations.

4.5.4.3   Config Pages

Click the **Config** tab, and then click the **Amplifier**, **LNB**, **Utility**, or **Redundancy** hyperlink to
continue.

4.5.4.3.1   Config | Amplifier

Use this page to configure the communications, operations, and alarms/faults handling for the
amplifier.

Figure 4-6. Config | Amplifier Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current operating
configuration.

Serial

- **Remote Address** – Enter a valid physical remote address from **0001** to **9999**.

- **Baud Rate** – Use the drop-down list to select the operating baud rate as **2400**, **4800**, **9600**,
  19200, or **38400** baud

Click **[Change Serial Configuration]** to save any changes.

Amplifier

- **Amplifier** – Use the drop-down list to select the amplifier as either **On** or **Off**.

- **Attenuation (dB)** – Enter a valid attenuation level (**00.00** to **20.00** dB) in 0.25 dB steps.
- **Attenuation Offset** – Enter a valid value, in dB, for the attenuation offset.

- **Fault Recovery** – Use the drop-down list to select Fault Recovery as either **Automatic** or **Manual**.

- **Mute** – Use the drop-down list to select the Mute function as either **Enabled** or **Disabled**.

- **AUX Mute** – Use the drop-down list to select the Auxiliary Mute Mode as either **Enabled** or **Disabled**.

- **Offline Mute** – Use the drop-down list to select the Offline Mute function as **Enabled**, **Disabled**, **MuteRx**, **MuteTx**, **MuteRx+LNB**, or **MuteTx+LNB.**

Click **[Change Configuration]** to save any changes. Otherwise, click **[Reset]** to revert to the previously assigned Amplifier settings.

Reference

- **Ref Freq Adjust** – Enter a numeric value from 0 to 255 to adjust the reference oscillator tuning voltage. The default value is set to 87.

- **Ext Ref Mute** – Use the drop-down list to select the Eexternal Reference Not Present Mute Mode as either **Enabled** or **Disabled**.

Click **[Change Configuration]** to save any changes. Otherwise, click **[Reset]** to revert to the previously assigned Reference settings.

Low Power Forward Threshold (dBm)

Use this field to set the threshold value, in dBm, for the low forward power alarm/fault. When the forward power monitor is set to **Alarm** or **Fault** instead of the factory default of **Mask**, and the forward power drops below the specified value, the alarm/fault is indicated.

Setting this parameter to the default value of 00.00 effectively disables the threshold.

Click **[Change]** to save any changes. Otherwise, click **[Reset]** to revert to the previously assigned Low Power Forward Threshold setting.

FSK Address

Use this field to set the FSK (Frequency Shift Keying) Address from **01** to **15**. Click **[Change]** to save any changes. Otherwise, click **[Reset]** to revert to the previously assigned FSK Address.

4.5.4.3.2   Config | LNB

Use this page to configure Low-Noise Block Downconverter parameters, and display the LNB status for L-Band operation.

Figure 4-7. Config | LNB Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current operating configuration.

LNB Config

- **LNB Current Source** – Use the drop-down list to select this feature as either **Enabled** or **Disabled**.

- **Switch Bias Tee** – Use the drop-down list to select either **Through State** (unmute LNB) or **Off State** (mute LNB).

- **LNB Current Window** – Use the drop-down list to select this feature as either **Enabled** or **Disabled**.

- **LNB Current Window (%)** – This field defines the size of the LNB Current Window, and determines the fault thresholds for the LNB current draw.

  Any LNB current reading that is outside the window may generate an alarm, a fault, or may be masked entirely depending on the state of the user-configured fault mask (see the **MSK** command syntax in **Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT** for more information).

  For example: If the LNB draws 100mA, and the LNB current fault window is set to the **default** value of **30(%)**, then the allowable current draw for the LNB will be from 70 mA minimum to 130 mA maximum because the window is +/- 30% centered on the calibrated LNB current draw.

Click **[Submit]** to save any changes.

Calibrate LNB Current

> **The LNB should be calibrated only when it is running at nominal operating conditions.**

The value of the LNB Current Supply (in mA) is provided here as a reference point. The LNB current alarm upper and lower thresholds are determined by this calibrated LNB reference point and the LNB current window setting.

Click **[Calibrate]** to perform an LNB calibration and display the updated **read-only** value.

4.5.4.3.3   Config | Utility

Use this page to configure LPOD operating parameters.

Figure 4-8. Config | Utility Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current operating configuration.

Date and Time

- Enter a date using international format in the form DD/MM/YY (where DD = day [01 to 31], MM = month [01 to 12], and YY = year [00 to 99]).

- Enter a time using HH:MM:SS format (where HH = hour [00 to 23], MM = minutes [00 to 59], and SS = seconds [00 to 59]).

Click **[Change Date/Time]** once you enter the desired date and time.

Circuit ID

Enter a Circuit ID (unit identification label) string of up to 48 characters.

Click **[Change CID]** once you compose the desired unit identification label.

Current Active Firmware Image # *(read-only)*

The selected **Current Active Firmware Image** is identified here. In this example, **Image 2** is the **Current Active Firmware Image**.

Next Reboot Image

Use the drop-down list to select the Next Reboot Image as **Image 1** or **2**. Press **[Submit]** when done.

Perform Soft Reboot

Click **[Reboot Now]** to reboot the LPOD using the **Current Active Firmware Image**.

Firmware Information *(read-only)*

This **read-only** scrollable window provides information about the currently loaded Bootrom. For the complete Bulk1 and Bulk2 information, scroll through all the constituent firmware blocks that make up the bulk.

Part Number *(read-only)*

This **read-only** scrollable window provides identifying part number information for the unit in use.

4.5.4.3.4   Config | Redundancy

Appendix A. 1:1 REDUNDANCY

Use this page to configure the LPOD's Redundancy Switch Mode.

Figure 4-9. Config | Redundancy Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current operating configuration.

Redundancy

To update the page to the current redundancy configuration: Click **[Refresh]**.

Enable Redundancy Switch Mode

Use the drop-down list to select the Switch Mode as follows:

- **Off** – Disables redundancy.

- **1:1 Red TX** – Enables 1:1 redundancy with transmit switch control.

- **1:1 Red TX+RX** – Enables 1:1 redundancy with transmit and receive switch control.

- **Manual:** Enables manual redundancy mode.

Click **[Change]** once the desired mode selection has been made.

Online Status

This **read-only** section displays the active status for the unit as either **Online** or **Offline**.

Force Online

To force a unit to go active (online): Click **[Force Online]**.

4.5.4.4   Status Pages

Use these pages to access to event logging, operational statistics, status, FET windows, and operational trending graphs.

Click the **Status** tab, and then click the **Summary**, **Status**, **FETs, Events**, **Statistics**, or **Trending Graphs** hyperlink to continue.

4.5.4.4.1   Status | Summary

Use this *read-only* page to view pertinent condensed information about the LPOD unit and its current operating state.
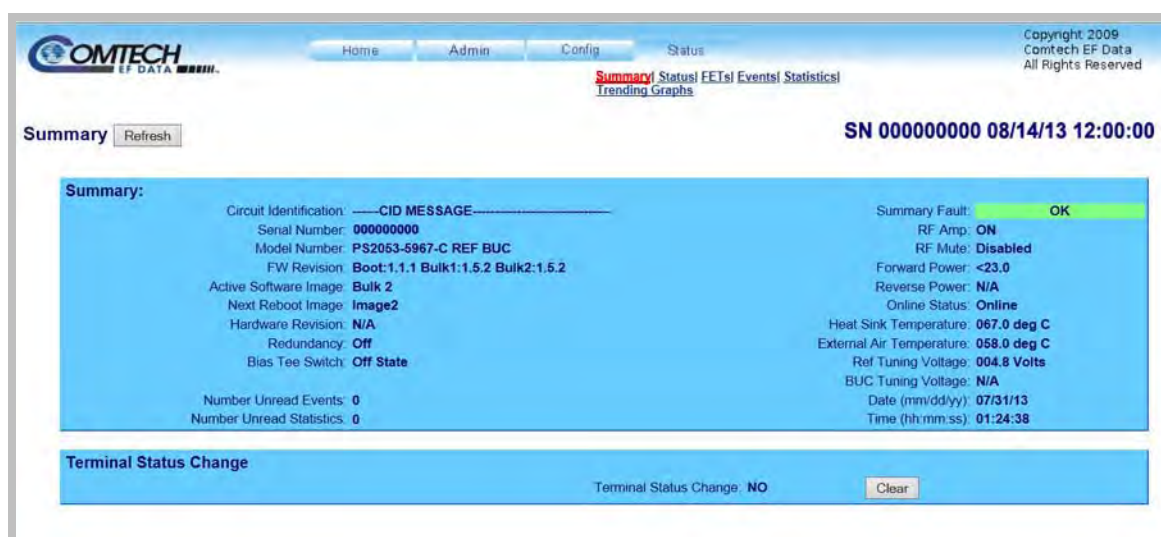
Figure 4-10. Status | Summary Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current polled configuration and operating conditions.

Summary

The **Summary Fault** line indicates that no faults are present with "**OK**" on green background. If a fault exists, the **Summary Fault** message changes to "**FAULT**" on a red background. Should this occur, review the logged faults and alarms on the **Status | Events** page (see **Sect. 4.5.4.4.2**).

Terminal Status Change

Use this section to determine if any configuration changes have been made to the unit since the last time the Terminal Status Change flag was reset by clicking **[Clear]**.

If Terminal Status Change reads **NO**, this indicates that there have been no changes in the unit configuration since the last time the Status Change flag was Cleared. Otherwise, the Terminal Status Change will read **YES**, when a "status change" occurs for one or more of the following reasons:

- An operating parameter is changed, e.g., when a command that changes an operational value is executed successfully;

- A fault condition is triggered;

- A redundant switchover occurs.

4.5.4.4.2   Status | Status

Use this *read-only* page to review all pertinent information about the LPOD.

> **Unlike the remaining pages available through this interface that refresh/update only when manually selected, the 'Status | Status' page updates automatically once every 10 seconds. Even with this automatic refresh function, you may click [Refresh] to update the operational status parameters found on this page.**

Figure 4-11. Status | Status page

4.5.4.4.3   Status | FETs

Use this **read-only** page to monitor the current operating status of the LPOD's Q01 through Q09 RF Power **F**ield **E**ffect **T**ransistor**s** (FETs) that are installed in the RF amplifier.
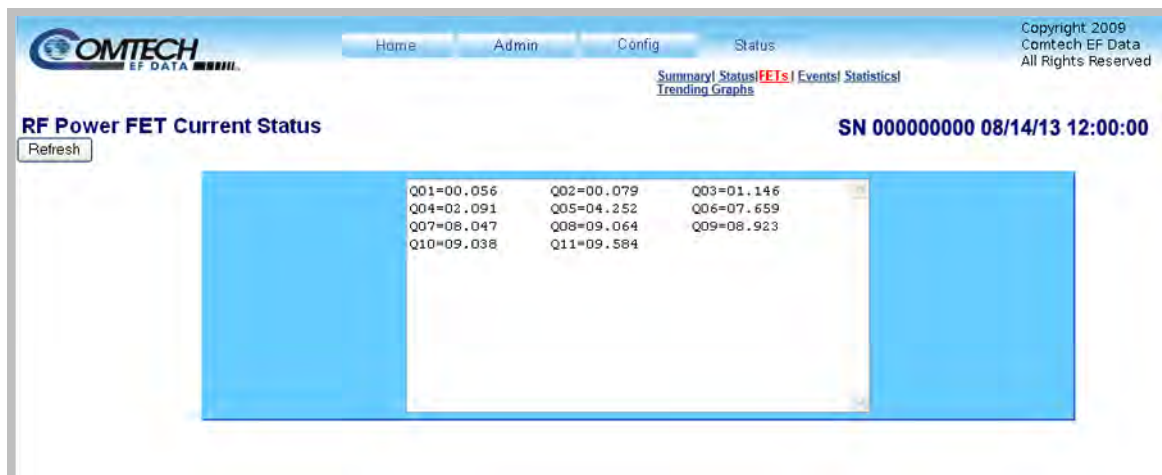
Figure 4-12. Status | FETs page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current polled configuration and operating conditions.

4.5.4.4.4   Status | Events

Use this page to view with all pertinent information about stored events, and to define the alarm parameters that determine how ongoing LPOD operations shall trigger events and alarms.

Figure 4-13. Status | Events Page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current polled configuration and operation conditions.

Unread Stored Events

This **read-only** *s*crollable window displays the unread stored events log in sequential, date-stamped format. A running tally of the number of unread stored events is displayed in the window header. The unit returns and displays the five oldest stored events in the alarm log. All events that are read from the log are also automatically removed from the log.

Manage the unread Stored Events window as follows:

- **Read Next Five Events** – Select to display the next five unread stored events in the log.

- **Clear Events Log** – Select to clear all stored events from the log.

- **Initialize Events Pointer** – Select to reset the internal pointer to allow queries to start at the beginning of the stored events log.

Click **[Submit]** to execute the choice – the window will update according to the selection made.

Alarm Mask

Use the drop-down lists to select each alarm as **Fault**, **Alarm,** or **Masked** for:

- **Low Forward RF Power**

- **Fan Speed**

- **LNB 22V Power Supply**

- **External Reference Lock Detected**

- **LNB Current Detect**.

Click **[Change Alarm Mask]** to save these settings. Otherwise, click **[Reset]** if you wish to revert to the previously assigned Alarm Mask settings.

4.5.4.4.5   Status | Statistics

Use this page to review all unread (stored) statistics, and to configure how the LPOD handles
and displays statistics.

Figure 4-14. Status | Statistics page

Click **[Refresh]** (at the top of the page) to update the page appearance to the current polled
operating conditions.

Unread Stored Statistics:

This *s*crollable window displays the unread stored statistics log in sequential, date-stamped
format. This page displays a running tally of the number of unread stored statistics in the
window header. The unit returns and displays the five oldest stored statistics; all events that are
read from the log are also automatically removed from the log.

Manage the Unread Stored Statistics window as follows:

- **Read Next Five Statistics** – Unit returns the oldest five unread stored statistics that have not
  yet been read in the log. If there are less than five events to be retrieved, the remaining
  positions are padded with zeros. If there are no new events, the counter in the header reads
  000.

- **Initialize Statistics Pointer** – Resets the internal pointer to allow queries to start at the
  beginning of the statistics log.

Click **[Submit]** to execute the choice – the window updates according to the selections made.

Statistics Configuration

- **Statistics Logging** – Use the drop-down list to select either **Enable** or **Disable** to set the Statistics Logging function.

- **Statistics Interval** – Enter the interval, in minutes, at which statistics are logged. Minimum resolution is 1 minute (001); maximum is 99 minutes (099). Default is 90 minutes (090).

- **Statistics Averaging** – Use the drop-down list to select either **Enable** or **Disable** to set the Statistics Averaging function:

  o When **Enabled**, statistics data is averaged at a rate of once per second for 10 seconds.

  o If **Disabled**, burst values will be logged instead of averaged values.

Click **[Submit]** once you have completely defined the statistics' reporting parameters.

4.5.4.4.6   Status | Graphs

This scrollable page features a universal page controls bar plus seven trending and operations graphs that provide statistics for the following parameters:
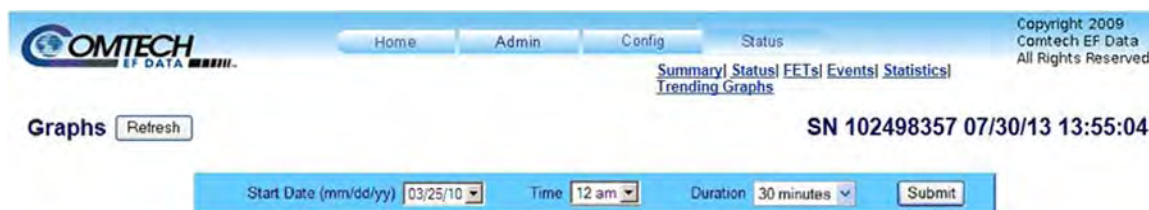
- **Temperature**
- **Power**
- **LNB Current**
- **Amplifier Status**
- **Mute Status**
- **Online Status**
- **Minimum Fan Speed**

Figure 4-15. Status | Graphs Page

Click **[Refresh]** (at the top of the page) to update the graphs to their current polled states.

Control Bar and Refresh Tab

Use the Control Bar to choose the time, date, and duration of the trending information displayed on the graphs. The graphs are all tied to the same 'x' scale so that you can more easily correlate data between the graphs.

Note the following:

- **Start Date (mm/dd/yy):** Once a unit has been in operation for 24 hours or more, use the drop-down list to select a date – up to a maximum of 28 days, including the present date – from which to compile data. If a unit has *not* been in operation for 24 hours, only **present** will be available.

- **Time:** Once a unit has been in operation for 24 hours or more, use this drop-down list to select the time on the hour – 24 hours, from **12 am** to **11 pm**, are available. Note that, for the first 24 hours of operation (or beyond if the time has accrued), if you select **present** as the **Start Date**, then the **Time** drop-down list becomes unavailable for selection and dim as shown here.

- **Duration:** Use the drop-down list to select the block of time in which data is compiled for the graphs. Select **30 minutes**, **1 hour**, **2 hours**, **4 hours, 6 hours**, **8 hours, 12 hours, 24 hours**, or **48 hours**.

> **The LPOD stores the trending data to flash memory once per hour. If you power down the unit before the data can be written to memory, the last 60 minutes of data will be lost.**

Click **[Submit]** to execute the choice once the configuration parameters have been defined; then, click the **[Refresh]** tab to update the graphs with the most current trending parameters (note that when the page refreshes, the **Power Graph** resets to display the default unit of **dBm**).

Temperature Graph
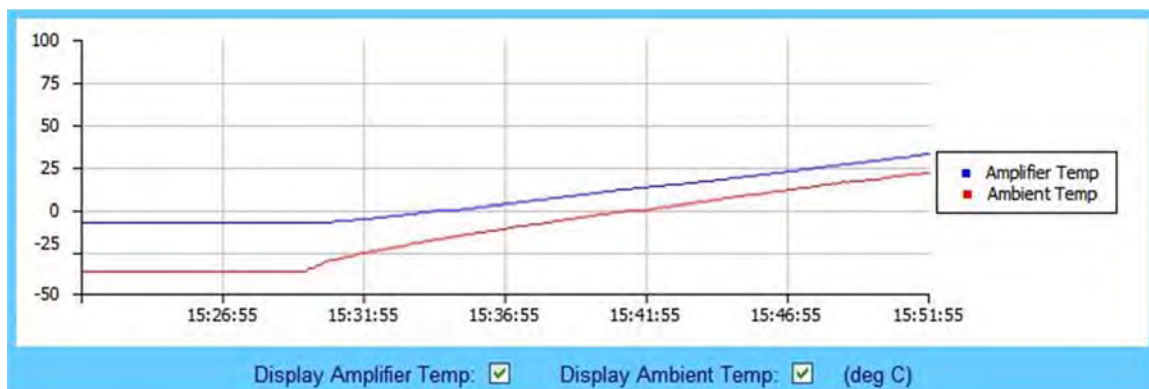
As noted by the graph legend, the blue line displays the unit's Amplifier (heat sink) temperature; the red line displays the Ambient (outdoor) temperature, if the required sensor has been installed in the unit.

You may control the appearance of either temperature by deselecting the pertinent checkbox provided at the bottom of the graph. The graph will dynamically update after the next polling cycle (every five seconds), when the deselected parameter is removed from both the graph and its legend.

Power Graph
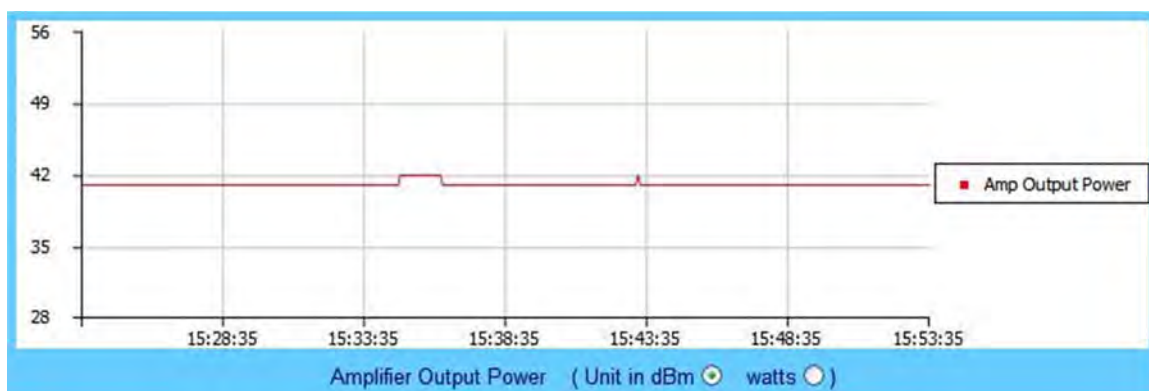
The power graph displays the unit's output power with 1dB resolution. You may define whether the graph depicts the unit of measurement as **dBm** (the default setting) or **watts** by selecting the desired Amplified Output Power unit at the bottom of the graph. The graph will dynamically update after the next polling cycle (every five seconds) to the desired parameter.

> **Whern you click the [Refresh] tab, the graph reverts to the default display (Unit in dBm).**

LNB Current Graph
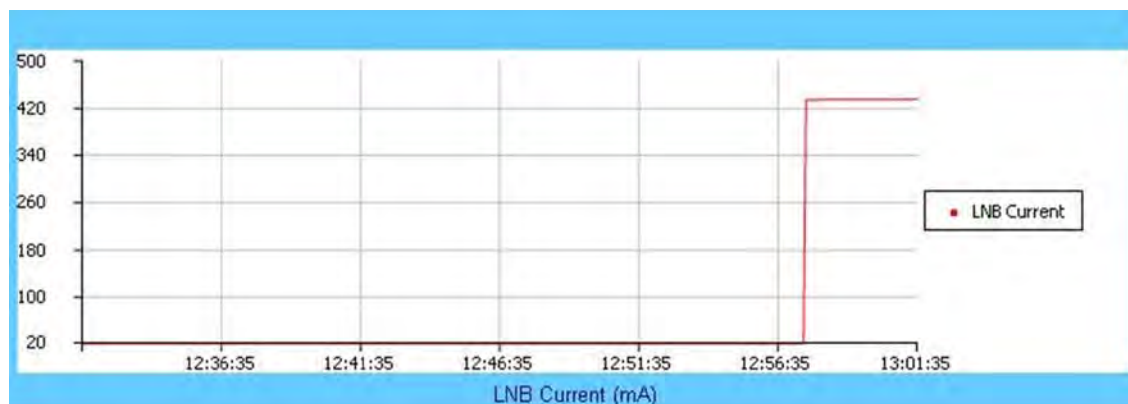
This graph displays the LNB current only if an LNB is connected to the system and is drawing current from the LNB current source.

Amplifier Status Graph
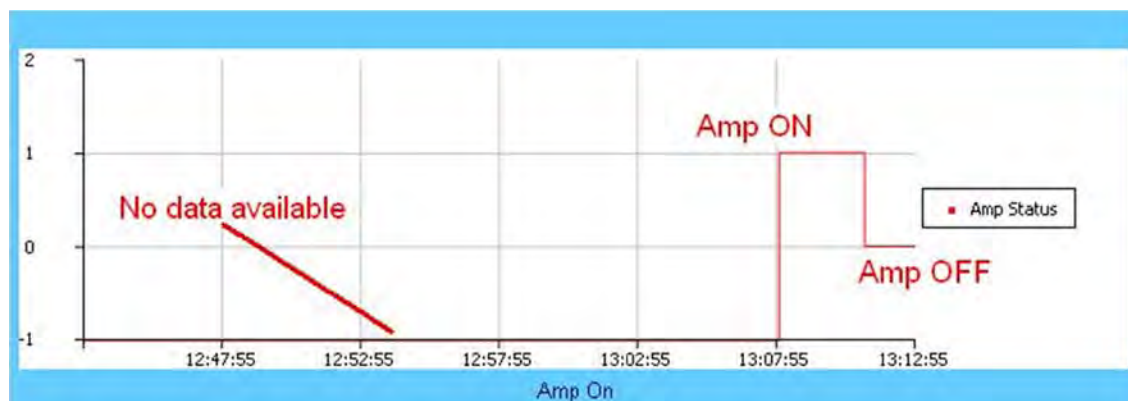
This graph displays the state of the RF amplifier (**On/Off**). Note that, as shown in the example, **On** is represented by a **1** (one); **Off** is represented by a **0** (zero); if no data is available, then a **-1** (negative one) is displayed.

Mute State Graph
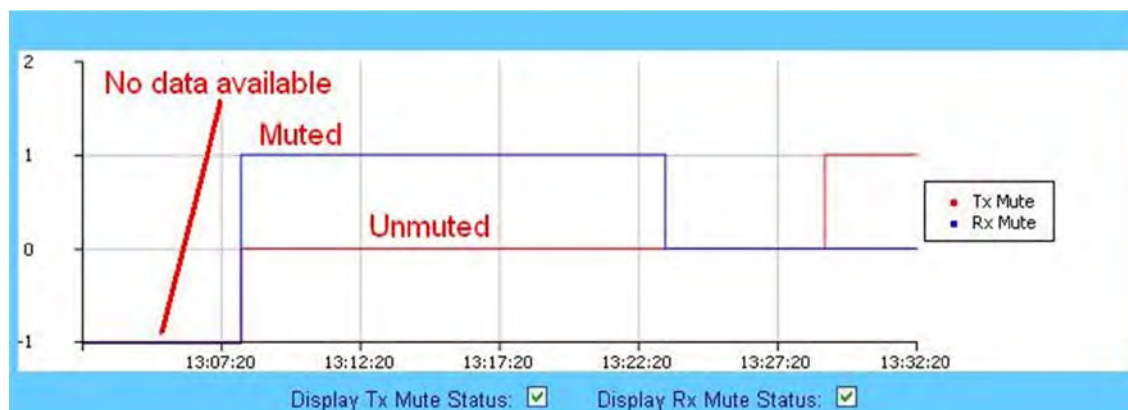
This graph displays the mute state (i.e., bias tee switch state as open = *muted*, or through path = *unmuted*) for the Tx Mute (red line) and the Rx Mute (blue line). Note that a logic high on the graph equals a *muted* condition; a logic **0** (zero) indicates an *unmuted* condition; a **-1** (negative one) is displayed if the data is *unavailable*.

The page displays both Tx and Rx Mute data by default. You may control the appearance in the graph of either Tx Mute or Rx Mute by deselecting the pertinent checkbox provided at the bottom of the graph. The graph will dynamically update after the next polling cycle (every five seconds), when the deselected parameter is removed from both the graph and its legend.

Online Status Graph
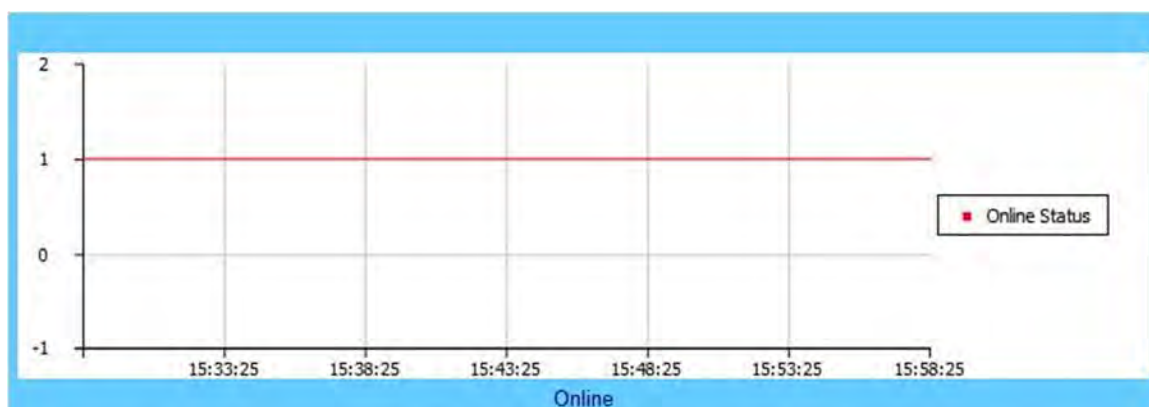
This graph displays the unit's online state. Note that a **1** (one) indicates the unit is *online*; a **0** (zero) indicates the unit is *offline*; a **-1** (negative one) indicates that the data is *unavailable*.

Minimum Fan Speed Graph
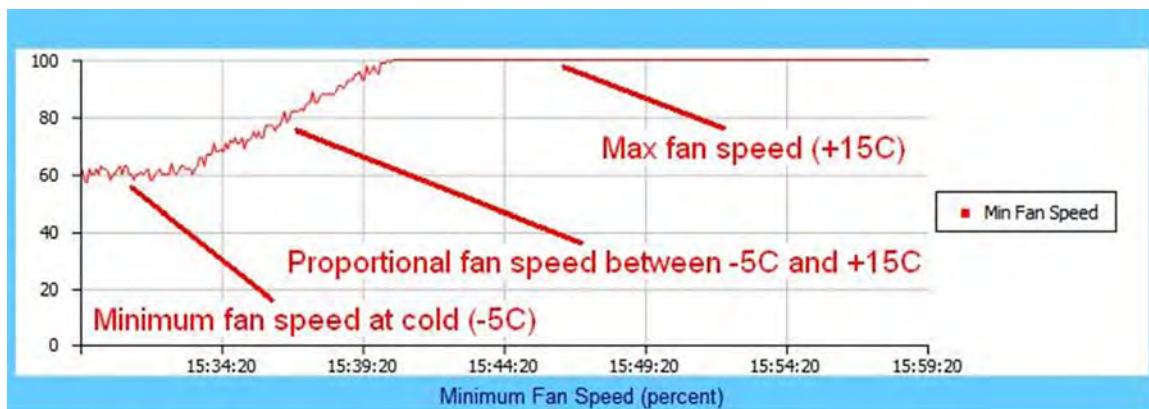
This graph displays the slowest fan speed of any of the fans installed in the system. The fan speed is proportional to the unit's heatsink temperature from -5°C and +15°C. At temperatures at or below -5°C, the LPOD minimizes its fan speed; at temperatures at or above +15°C, the LPOD maximizes its fan speed. The example provided here demonstrates the fan running at minimum, proportional, and maximum speeds.

Notes:

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Notes:

Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT

5.1 Overview

Serial-based remote product management of Comtech EF Data's LPOD family of Outdoor Amplifiers / Block Up Converters (BUCs) is available using the LPOD's **'J6 | COM 1'** port. Some key parameters and procedures and their associated remote commands and queries are summarized, followed by detailed instructions for use of the serial remote control communication command and query interface.

5.2 Key Operational Parameters

For detailed information about the remote commands and queries mentioned in this section, see **Sect. 5.4 Remote Commands and Queries** in this chapter.

5.2.1 RF Input Level

The required RF input level to reach the full rated output power of the SSPA is determined by the individual amplifier maximum gain and power rating.

For Example: If the test data of an SSPA rated for 250W (54 dBm) indicated a gain of 75 dB, then a signal of **54 dBm – 75 dB = -21 dBm** would approximately give the rated output power.

Increasing input power beyond this level would result in an output signal with increasingly higher levels of distortion. Of course, if the LPOD attenuation control is utilized, a higher-level input signal level can be accommodated. **The maximum input level should never exceed 15dBm, or permanent damage to the unit may occur.**

5.2.2   Attenuator Control

The LPOD gain can be attenuated over its specified range by exercising the **ATT** command. The details for the format of this command are found later in this chapter.

5.2.3   Mute Control

The LPOD may be muted via software or discrete control:

- *Software –* Exercising the **MUT=1** command will "software" mute the unit.

- *Discrete Control –* When exercising the **AUX=1** command, the LPOD will be muted <u>until</u> Pin 'S' (on the '**J6 | COM1**' Discrete Control Connector) is pulled to ground (Pin 'K'). At that time, the unit unmutes.

The Mute command provides over 60 dB of RF on/off isolation. However, the Mute command only turns off the first few low power stages of the amplifier, the high power stages remain on. By allowing the higher power transistors to stay on, the SPOD remains in more thermally stable state should the mute condition be removed.

If the user desires to completely turn off the bias to the entire amplifier (perhaps to conserve energy in a redundant system), both the **MUT=1** and **AMP=0** commands should be executed. For normal transmit operation, **MUT=0** and **AMP=1** are required.

5.2.4   Faults

The M&C system monitors certain key functions of the LPOD for proper operation. Should any of these parameters exceed predetermined limits, the M&C system will declare a fault. The conditions that trigger a fault are:

- Any power supply more than ± 10% outside its nominal value.

- Fan less than 25% of maximum speed.

- I2C internal bus communications fault.

- Thermal Shutdown – A temperature fault is indicated if the unit is +>90°C. This creates a summary fault and will cause the unit to mute itself and switch to the back-up unit (if in a redundant system). However, the 10V supply to the FET transistors will remain on until the unit reaches the thermal shutdown temperature of ≥ >95°C. For protection reasons, the unit will shut down the 10V supply to the power transistors at temperatures >95°C.

- Firmware checksum error at power up.

- FPGA done indicator error at power up.

- *Block Up Converter (BUC) unlocked.

- Redundant waveguide switch position fault (applies to redundant mode operation only).

- Redundant inter-unit link fault (applies to redundant mode operation only).

- Low Noise Block Down Converter (LNB) current over limit.

The following parameters can be user defined to report an alarm condition, a fault condition, or the parameter can be ignored completely by masking it:

- RF amplifier low output power (user adjustable value).

- Internal reference oscillator unlocked.

- *LNB current outside specified window.

- *LNB voltage out of tolerance.

*If this parameter generates a fault condition, the RF output will be muted.

5.2.5   Power Detector

A power detector is provided to monitor the output power. It has a useful range of over 20 dB, referenced to the unit's rated P1dB point, and its value can be read by exercising the **RMS** command. The test data supplied with each unit gives an indication of the excellent accuracy and flatness of the power monitor over the frequency band of operation.

5.2.6   Some Common Commands

A few of the most common commands and queries are:

- **RMS** – **R**etrieve **M**aintenance **S**tatus. Displays voltages, fan speeds, Heatsink temperature, output power monitor reading, etc.

- **RCS** – **R**etrieve **C**onfiguration **S**tatus. Displays current attenuation, mute, amplifier, online, etc. status.

- **RAS** – **R**etrieve **A**larm **S**tatus. Displays current alarm or fault status.

Full details for each of these are listed in **Sect. 5.4** of this chapter.

5.2.7   End-of-Life Commands

Certain commands/queries are being marked by Comtech EF Data as End-of-Life (EOL). As noted in the format *<description>*[E] in the **Parameter Type** field (in the Remote Commands and Queries tables in **Sect. 5.4**), while these commands are fully supported in this product it is highly recommended that the equivalent new commands be used for new implementations. The new commands generally follow the outdated commands:

EOL-designated Command/Query (Page #)	New Command/Query (Page #) / Comment
CAA (5-12)	CAE (5-12)
CUS (5-15)	Functionality not included in any other remote command/query
DAT (5-17)	DAY (5-17)
LNA (5-22)	RNE (5-30)
RET (5-28)	PNM (5-25) New query provides more exact unit hardware information
RSN (5-31)	SNO (5-33)
SFS (5-33)	Functionality not included in any other remote command/query
TNA (5-35)	TNE (5-35)

5.1   Remote Control Protocol and Structure

The electrical interface is either an EIA-485 multi-drop bus (for the control of many devices) or an EIA-232 connection (for the control of a single device), and data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets, of variable length, in accordance with the structure and protocol defined in later sections.

5.1.1   EIA-485

For applications where multiple devices are to be monitored and controlled, a full-duplex (or 4-wire) EIA-485 is preferred. Half-duplex (2-wire) EIA-485 is possible, but *is not preferred*.

In full-duplex EIA-485 communication there are two separate, isolated, independent, differential-mode twisted pairs, each handling serial data in different directions. It is assumed that there is a 'Controller' device (a PC or dumb terminal), which transmits data, in a broadcast mode, via one of the pairs. Many 'Target' devices are connected to this pair, which all simultaneously receive data from the Controller. The Controller is the only device with a line-driver connected to this pair – the Target devices only have line-receivers connected.

In the other direction, on the other pair, each Target has a Tri-Stateable line driver connected, and the Controller has a line-receiver connected. All the line drivers are held in high-impedance mode until one (and only one) Target transmits back to the Controller.

Each Target has a unique address, and each time the Controller transmits, in a framed 'packet' of data, the address of the intended recipient Target is included. All of the Targets receive the packet, but only one (the intended) will reply. The Target enables its output line driver, and transmits its return data packet back to the Controller, in the other direction, on the physically separate pair.

EIA-485 (Full Duplex) Summary:	
Two differential pairs	One pair for Controller to Target, one pair for Target to Controller.
Controller-to-Target pair	Pair has one line driver (Controller), and all Targets have line-receivers.
Target-to-Controller pair	Pair has one line receiver (Controller), and all Targets have Tri-State drivers.

5.1.2 EIA-232

This is a much simpler configuration in which the Controller device is connected directly to the Target via a two-wire-plus-ground connection. Controller-to-Target data is carried, via EIA-232 electrical levels, on one conductor, and Target-to-Controller data is carried in the other direction on the other conductor.

5.1.3 Basic Protocol

Whether in EIA-232 or EIA-485 mode, all data is transmitted as asynchronous serial characters, suitable for transmission and reception by a UART. The character format should be 8N1 (8 data bits, no parity, 1 stop bit). The baud rate may vary from 2400 to 38400 baud.

All data is transmitted in framed packets. The Controller is assumed to be a PC or ASCII dumb terminal, which is in charge of the process of monitor and control. The Controller is the only device that is permitted to initiate, at will, the transmission of data. Targets are only permitted to transmit when they have been specifically instructed to do so by the Controller.

All bytes within a packet are printable ASCII characters, less than ASCII code 127. In this context, the Carriage Return and Line Feed characters are considered printable.

All messages from Controller-to-Target require a response – with one exception. This will be either to return data that has been requested by the Controller, or to acknowledge reception of an instruction to change the configuration of the Target. The exception to this is when the Controller broadcasts a message (such as Set time/date) using Address 0, when the Target is set to EIA-485 mode.

5.1.4 Packet Structure

Controller-to-Target						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
 < ASCII code 60 (1 character)	0-9 ASCII codes 48-57 (4 characters)	/ ASCII code 47 (1 character)	A-Z, a-z ASCII codes 65-90, 97-122 (3 characters)	= or ? ASCII codes 61 or 63 (1 character)	 (n characters)	Carriage Return ASCII code 13 (1 character)

Example: <0412/MUT=1{CR}

Target-to-Controller						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
> ASCII code 62 (1 character)	0-9 ASCII codes 48-57 (4 characters)	/ ASCII code 47 (1 character)	A-Z, a-z ASCII codes 65-90, 97-122 (3 characters)	=, ?, !, or * ASCII codes 61,63,33 or 42 (1 character)	(From 0 to n characters)	Carriage Return, Line Feed ASCII codes 13,10 (2 characters)

Example: >0412/MUT=1{CR}{LF}

5.1.4.1 Start of Packet

Because this is used to provide a reliable indication of the start of packet, these two characters may not appear anywhere else within the body of the message:

- **Controller-to-Target:** This is 'less-than' the character '**<**' (ASCII code 60).

- **Target-to-Controller:** This is the 'greater-than' character '**>**' (ASCII code 62).

5.1.4.2 Target Address

Up to 9,999 devices can be uniquely addressed. In EIA-232 applications this value is set to 0. In EIA-485 applications, the permissible range of values is 1 to 9999.

The Controller sends a packet with the address of a Target – the destination of the packet. When the Target responds, the address used is the same address, to indicate to the Controller the source of the packet. The Controller does not have its own address.

5.1.4.3 Address Delimiter

This is the 'forward slash' character ' **/** ' (ASCII code 47).

5.1.4.4 Instruction Code

This is a three-character alphabetic sequence that identifies the subject of the message. Wherever possible, the instruction codes have been chosen to have some significance.

For Example: GAC for **G**lobal **A**mplifier **C**onfiguration; **IPA** for **IP A**ddress, etc. This aids in the readability of the message, should it be displayed in its raw ASCII form.

Both upper case and lower case alphabetic characters may be used (A-Z *and* a-z, ASCII codes 65-90 *and* 97-122).

5.1.4.5 Instruction Code Qualifier

This single character further qualifies the preceding instruction code. Code Qualifiers obey the following rules:

1) From **Controller-to-Target**, the only permitted values are:

= (ASCII code 61	This character is used as the **assignment** operator, and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument(s) that follow it. **For Example:** In a message from Controller-to-Target, **MUT=1** would mean 'enable the Mute function'.
? (ASCII code 63)	This character is used as the **query** operator, and is used to indicate that the Target should return the current value of the parameter defined by the preceding byte. **For Example:** In a message from Controller-to-Target, **SWR?** would mean 'returns the value of the internal software revision installed in the unit'.

2) From **Target-to-Controller**, the only permitted values are:

= (ASCII code 61)	This character is used in two ways: **First**, if the Controller has sent a query code to a Target (**for Example: MUT?**, meaning '*is the Mute enabled or disabled?*'), the Target would respond with **MUT=x**, where **x** represents the state in question: 1 being 'enable' and 0 being 'disable'. **Second**, if the Controller sends an instruction to set a parameter to a particular value, and if the value sent in the argument is valid, then the Target will acknowledge the message by replying with **MUT=** (with no message arguments).
? (ASCII code 63)	This character is used only if the Controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is not valid, the Target will acknowledge the message by replying, for example, with **MUT?** (with no message arguments). This indicates that there was an error in the message sent by the Controller.

! (ASCII code 33)	This character is used only if the Controller sends an instruction code which the Target does not recognize, the Target will acknowledge the message by echoing the invalid instruction, followed by the ! character. **Example: XYZ!**
* (ASCII code 42)	This character is used only if the Controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is valid, BUT the Target is in the wrong mode (e.g., standby mode in redundancy configuration) and will not permit that particular parameter to be changed at that time, the Target will acknowledge the message by replying, for example, with **MUT*** (with no message arguments).
# (ASCII code 35)	This character is used only if the Controller sends an instruction code which the Target cannot currently perform because of hardware resource issues, then the Target will acknowledge the message by echoing the invalid instruction, followed by the # character. This response can only occur if the operator sends two or more 'hardware configuration' type commands without allowing adequate time between commands for the hardware to be configured. For example, if the operator issued commands to change both the frequency and the attenuation with less than 100 milliseconds between commands, and if this response is returned, then the command has not been accepted and the operator must resend the command.

5.1.4.6 Optional Message Arguments

Arguments are not required for all messages. Arguments are ASCII codes for any printable character.

5.1.4.7 End of Packet

- **Controller-to-Target**: This is the 'carriage return' character (ASCII code 13).

- **Target-to-Controller**: This is the two-character sequence 'carriage return' (ASCII code 13), and 'line feed' (ASCII code 10).

Both indicate the valid termination of a packet.

5.2   Remote Commands and Queries

Column 'C' = Command; **Column 'Q'** = Query; columns marked '**X**' designate instruction code as *Command only*, *Query only*, or *Command/Query*.

- Where an **Instruction Code** is noted XXX^E this designates a command/query as **End of Life (EOL)**. While the underlying command will remain, the specific functionality will be obsolete and should not be used for new implementations. There generally will be a different command elsewhere that incorporates the marked functionality. See **Sect. 5.2.7** for more information.

- Where an **Instruction Code** is noted XXX^O this designates a command/query that is available only when a reference oscillator is installed.

CODE	C	Q	PAGE		CODE	C	Q	PAGE		CODE	C	Q	PAGE		CODE	C	Q	PAGE
AFR	X	X	5-11		GAC	X	X	5-19		PNM		X	5-25		SRC	X	X	5-33
AMP	X	X	5-11												SSC	X	X	5-33
AOF	X	X	5-11		IEP	X		5-19							SSI	X	X	5-33
ATT	X	X	5-12		IMG	X	X	5-19		RAS		X	5-26		SSL	X	X	5-34
AUX	X	X	5-12		IPA	X	X	5-20		RBT	X		5-27		SSN	X	X	5-34
					IPG	X	X	5-20		RCS		X	5-27		STA	X	X	5-34
CAA^E	X		5-12		ISP	X		5-20		RED	X	X	5-27		STB	X	X	5-34
CAE	X		5-12							REF	X	X	5-28		STV	X	X	5-34
CAS		X	5-13		LCS	X	X	5-20		RET^E		X	5-28		SWC	X	X	5-34
CCS		X	5-14		LCW	X	X	5-21		RFS		X	5-28		SWR		X	5-34
CFS		X	5-14		LNA^E		X	5-21		RMS		X	5-29					
CID	X	X	5-14		LPT	X	X	5-21		RNE		X	5-30					
CLC	X	X	5-15		LRS	X	X	5-22		RNS		X	5-31					
CMS		X	5-16							RSN^E		X	5-31		TIM	X	X	5-35
CSL	X		5-15		MAC		X	5-22		RUS		X	5-31		TMP		X	5-35
CUS^E		X	5-15		MOP		X	5-23							TNA^E		X	5-35
CWE	X	X	5-16		MSK	X	X	5-24							TNE		X	5-35
					MUT	X	X	5-24		SBR	X	X	5-32		TPE		X	5-35
DAT^E	X	X	5-17							SBT	X	X	5-32		TPS	X	X	5-35
DAY	X	X	5-17		NUE		X	5-24		SFA	X	X	5-32		TSC	X	X	5-36
					NUS		X	5-24		SFS^E		X	5-32					
ESA	X	X	5-17							SNA	X	X	5-33					
ESL	X	X	5-17		OFM	X	X	5-25		SNM	X	X	5-33					
ESW	X	X	5-18		ONL	X	X	5-25		SNO	X	X	5-33		XRM	X	X	5-36
FRW		X	5-18							SPA	X	X	5-33					

Note: The following codes are used in the 'Response to Command' column:	
CODE	MEANING
=	Message OK
?	Received OK, but invalid arguments found
*	Message OK, but not permitted in **Current** mode
#	Message OK, but only permitted in **Remote** mode
!	Unknown command

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Auto Fault Recovery	AFR=	1 byte	Command or Query. Sets or returns auto fault recovery in the form x, where: 　0=Disabled 　1=Enabled (**Default value**) If auto fault recovery is enabled, it will cause the output return to its pre-fault mute condition if all faults are cleared. If disabled, the output will remain muted even if all faults are cleared. The LPOD output will automatically be muted if one of the following fault conditions occurs: 　• 　BUC lock detect fault 　• 　LNB current fault (see **Note**) 　• 　LNB voltage fault (see **Note**). **Note:** These faults can be user defined as faults, alarms, or masked (see MSK command for more info). **Example:** <1/AFR=1'cr' >0001/AFR='cr''lf'	AFR= AFR? AFR*	AFR?	AFR=x (See Description of Arguments)
RF Power Amplifier State	AMP=	1 byte	Command or Query. Sets or returns the RF power amplifier state in the form x, where: 　0 = Off (**Default value**) 　1 = On **Note**: turning the amplifier off will disable the +10V supply, and mask it during fault checking. **Example:** <1/AMP=1'cr' >0001/AMP='cr''lf'	AMP= AMP? AMP*	AMP?	AMP=x (See Description of Arguments)
Attenuation Offset	AOF=	5 bytes	Command or Query. Sets or returns the attenuation offset level in the form xx.xx, where: 　xx.xx = 00.00 to 20.00, in dB, in 0.25 dB steps as factory default. Default value: 00.00 This value is not copied to the offline unit in a redundant system, but is added to the attenuation value upon a switchover. This provides a unit-specific fine-tune to maintain power levels appropriately in a redundant system. **Example:** <1/AOF=12.25'cr' >0001/AOF='cr''lf'	AOF= AOF? AOF*	AOF?	AOF=xx.xx (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Attenuation	ATT=	5 bytes	Command or Query.
			Sets or returns attenuation level in the form xx.xx, where:
			    xx.xx=00.00 to 20.00, in dB, in 0.25 dB steps as factory default.
			
			Default value: 10.00
			
			Example: <1/ATT=12.25'cr'
			         >0001/ATT='cr''lf'
				ATT=
				ATT?
				ATT*
					ATT?	ATT=xx.xx
						
						(See Description of Arguments)

Auxiliary Mute Enable	AUX=	1 byte	Command or Query.
			Sets or returns the auxiliary mute mode in the form x, where:
			    0=Disabled (**default value**)
			    1=Enabled
			
			Notes:
			1) When enabled, the mute control input on the remote com connector must be grounded to UN-MUTE the unit. Otherwise, the unit will be muted, and if a mute query is given (MUT?) the response will be MUT=2 to indicate a hardware controlled mute is present.
			2) Aux mute is one of several hardware mute states that can cause a MUT=2 to be reported. See the MUT command for more info on mute states.
			3) Auxiliary mute supersedes the user mute state so if the command MUT=1 is sent, then AUX=1 is sent, and the user shorts Pin K to Pin S on the discrete control connector then the RF mute will be disabled (MUT=0).
			
			Example (AUX Mute Enabled): AUX=1'cr'
				AUX=
				AUX?
				AUX*
					AUX?	AUX=x
						(See Description of Arguments)

Clear All Stored Alarms[E]	CAA=	None	Command only. Instructs the LPOD to clear all Stored Alarms. **This command takes no arguments.** **Example:** <1/CAA='cr' >0001/CAA='cr''lf'	CAA= CAA*	N/A	N/A
Clear All Stored Events	CAE=	None	Command only. Instructs the LPOD to clear all Stored Events. **This command takes no arguments.** **Example:** <1/CAE='cr' >0001/CAE='cr''lf'	CAE= CAE*	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Concise Alarm Status	N/A	44 bytes	Query only. This is the concise version of the RAS query. Returns the alarm status of the unit, response is semicolon delimited. **Example:** CAS=a;b;c;d;e;f;g;h;i;j;k;l;m;n;o;p;q;r;s;t;u;v;w;x;y;'cr''lf' where: a thru z = 0 (FT), 1 (OK), 2 (AL), 3 (NO), 4 (YS), 5 (MS), 6 (??), or 7 (NA) a = +24V Power Supply b = +24V Switch Power Supply c = +13/18V LNB Power Supply (see **Note**) d = +13.5V Power Supply e = +10V Power Supply f = +10V1 Amplifier Power Supply g = +10V2 Amplifier Power Supply (see **Note**) h = +7.8V Power Supply i = +5.8V Power Supply j = +2.5V Power Supply k = +1.2V Power Supply l = -5.8V Power Supply m = Fan#1 State n = Fan#2 State (see **Note**) o = Heatsink Temp p = Overtemp Shutdown q = IIC Status r = Forward Power Alarm s = Flash Checksum t = FPGA Done u = BUC Lock Detect (see **Note**) v = External Ref Lock Detect (see **Note**) w = LNB Current (see **Note**) x = Redundant Switch Condition (see **Note**) y = Redundant Link Status (see **Note**) z = Terminal Status Change Notes: 1) c, g, n, u, v, w, x, and y appear if the appropriate model/options have been selected/installed. 2) ?? is an invalid fault condition because hardware failed to respond to query (this value is accompanied by an I2C fault). 3) NA = not applicable. The unit does not include hardware support for this parameter.	CAS=	CAS?	CAS=x....x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Concise Configuration Status	N/A	26 bytes	Query only.
			This is the concise version of the RCS query. Returns the configuration status of the unit, in the form aa.aa;b;c;d;e;ff.ff;g;hhh, where:
			   aa.aa = attenuation in dB (ATT)
			   b = RF power amplifier state, 0 = Off, 1 = On (AMP)
			   c = mute state, 0 = un-muted, 1 = muted (MUT)
			   d = online status (ONL)
			   e = redundancy state and mode (ESW)
			   ff.ff = Attenuator offset in dB (AOF)
			   g = auto fault recovery mode (AFR)
			   hhh = External reference status, N/A = no external reference, 05M for 5 MHz, and 10M for a 10 MHz (See **Note**)
			
			Note: hhh will always be N/A if the internal reference oscillator option is **not** installed.
			
			Example: CCS=aa.aa;b;c;d;e;ff.ff;g;hhh; 'cr''lf'
				CCS=	CCS?	CCS= aa.aa;b;c;d;e; ff.ff;g;hhh (See Description of Arguments)

Concise RF Power FET Current Status	N/A	Length varies depending on number of FETs installed in the amplifier	Query only. This is the concise version of the RFS query. Returns the RF Power FET Current status. **Example:** CFS=xxx,xxx,x.x,x.x,..........,x.x,	CFS=	CFS?	CFS=x.....x (See description of RFS. Note that each argument is separated by a comma.)
Circuit Identification	CID=	48 bytes	Command or Query. Sets or returns a 48-byte user-defined string that identifies or names the unit or station. The CID is entered as one line, but it reads back from the unit as two 24-byte lines of data. Default value: ---------------------- Examples: <1/CID= Station #001--SSPA #01--'cr' >0001/CID= <1/CID?'cr' >0001/CID='cr' Station #001'cr' --SSPA #01--'cr''lf'	CID= CID? CID*	CID?	CID=x...x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Calibrate LNB Current	CLC=	none	Command or Query. Sets or returns, as a reference point, the value of the LNB Current Supply (in mA) in the form xxx.x. **Default value:** 000.0 The LNB current alarm point is then determined by the calibrated LNB reference point, and the LNB current window setting (see LCW command). **Note:** this command will return a mode error if the LNB current source output has not been enabled first (see LCS command). **Example:** <1/CLC='cr' >0001/CLC='cr''lf' The CLC query will return the value that was stored during the LNB current calibration. **Example:** <1/CLC?'cr' >0001/CLC=xxx.x where xxx.x is the calibrated LNB current value in mA.	CLC= CLC? CLC*	CLC?	CLC=xxx.x (See Description of Arguments)
Clear Statistics Log	CSL=	1 byte	Command only. Clears the statistics log entries. **This command takes no arguments.** **Example:** <1/CSL=1'cr' >0001/CSL='cr''lf'	CSL= CSL? CSL*	N/A	CSL=

Concise Utility Status [E]	N/A	15 bytes	Query only.
			Returns the Maintenance status of the unit, response is semicolon delimited, in the form aaaa;bbbbb;ccc where:
			   aaaa = Remote Unit Address
			   bbbbb = Remote Baud Rate
			   ccc = Reference oscillator tuning voltage DAC value (see **Note**)
			
			Note: ccc is only present if a reference oscillator is installed.
			
			Example:
			<1/CUS?'cr'
			>0001/CUS=aaaa;bbbbb;ccc;'cr''lf'
				CUS=	CUS?	CUS=x....x
						(See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Concise Maintenance Status	N/A	95 bytes	Query only.
			This is the concise version of the RMS command. Returns the Maintenance status of the unit, response is semicolon delimited, in the form aaa.a;bbb.b;ccc.c;ddd.d;eee.e;fff.f;ggg.g;hhh.h;iii.i;jjj.j;kkk.k;lll.l;mmm.m;nnn.n; ooo.o;ppp.p;qqq.q;rrr.r;sss.s;ttt.t where:
			   aaa.a = P24V1
			   bbb.b = P24V2
			   ccc.c = LNBVT (see **Note**)
			   ddd.d = P13VT
			   eee.e=P10V1
			   fff.f = A10V1
			   ggg.g = A10V2 (see **Note**)
			   hhh.h = P7V8T
			   iii.i = P5V8T
			   jjj.j = P2V5T
			   kkk.k = P1V2T
			   lll.l = N5V8T
			   mmm.m = FANR1 (see **Note**)
			   nnn.n = FANR2 (see **Note**)
			   ooo.o = BUCVT (see **Note**)
			   ppp.p = FWPWR
			   qqq.q = REFVT (see **Note**)
			   rrr.r = LNBCS (see **Note**)
			   sss.s = ATEMP
			   ttt.t = OTEMP (see **Note**)
			
			Note: ccc.c, ggg.g, mmm.m, nnn.n, ooo.o, qqq.q, rrr.r, and ttt.t will appear if the appropriate model/options have been selected/installed. Otherwise, the unused fields will display XXXXX.
			
			Example: <1/CMS?
			>0001/CMS=aaa.a;bbb.b;ccc.c;ddd.d;eee.e;fff.f;ggg.g;hhh.h;iii.i;jjj.j;kkk.k;lll.l;mmm.m;nnn.n;ooo.o;ppp.p;qqq.q; rrr.r;sss.s;ttt.t'cr''lf'
				CMS=	CMS?	CMS=x….x (See Description of Arguments)

LNB Current Window Enable	CWE=	1 bytes	Command or Query.
			Sets or returns the LNB current window alarm in the form x, where:
			   0=Disabled (**default value**)
			   1=Enabled (see Note)
			
			Note: If disabled, the LCW value will be retained, but unused.
			
			Example: <1/CWE=0'cr'
			>0001/CWE='cr''lf'
				CWE =
				CWE?
				CWE *
					CWE?	CWE =x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Set RTC (Real-Time-Clock) Date[E]	DAT=	6 bytes	Command or Query. Sets or returns the real-time clock date in the form **mmddyy**, where; 　dd = day of the month, from 01 to 31, 　mm = month of the year, from 01 to 12 　yy = year, from 00 to 96 (2000 to 2096) **Example** (date = April 24, 2003): <1/DAT=042403'cr' >0001/DAT='cr''lf'	DAT= DAT? DAT*	DAT?	DAT= **mmddyy** (See Description of Arguments)
Set RTC (Real-Time-Clock) Date	DAY=	6 bytes	Command or Query. Sets or returns the real-time clock date in the form **ddmmyy**, where; 　dd = day of the month, from 01 and 31, 　mm = month of the year, from 01 to 12 　yy = year, from 00 to 99 (2000 to 2099) **Example** (date = April 24, 2003): <1/DAY=240403'cr' >0001/DAY='cr''lf'	DAY= DAY? DAY*	DAY?	DAY= **ddmmyy** (See Description of Arguments)
Enable Statistics Averaging	ESA=	1 byte	Command or Query. Enables or Disables averaging of statistics data at a rate of once per second for 10 seconds, in the form x, where: 　0 = Disable (**default value**)(see **Note**) 　1 = Enable **Note**: If Disabled, burst values will be logged instead of averaged values. **Example:** <1/ESA=0'cr' >0001/ESA='cr''lf'	ESA= ESA? ESA*	ESA?	ESA=x (See Description of Arguments)
Enable Statistics Logging	ESL=	1 byte	Command or Query. Sets or returns the statistics logging function in the form x, where: 　0 = Disable (**default value**) 　1 = Enable **Example:** <1/ESL=1'cr' >0001/ESL='cr''lf'	ESL= ESL? ESL*	ESL?	ESL=x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Enable Redundancy Switch Mode	ESW=	1 byte	Command or Query. Sets or returns the redundancy state in the form x, where: 0 = Off (**default value**) 1 = 1:1 Redundancy TX (Only TX switch installed) 2 = 1:1 Redundancy TX + RX (TX and RX switch installed) 5 = 1:1 Manual redundancy mode (used for debugging, or redundant system setup)(see **Note**) **Note:** Manual redundancy does not support automatic switching, and the offline unit will not poll the online unit to update its configuration. **Example:** <1/ESW=1'cr' >0001/ESW='cr''lf'	ESW= ESW? ESW *	ESW?	ESW=x
Retrieve Firmware Number	N/A		Query only Returns the firmware type(s) loaded into the unit in the form FW-AAAAAAA B.B.BB DD/MM/YY, where: FW-AAAAAAA = the firmware part number B.B.BB = the version number DD/MM/YY = Day/Month/Year firmware released **Example:** <1/FRW?'cr' >0001/FRW= Boot: FW-0000082 0.0.1a 04/09/08 Bulk1: FW-0000078 0.0.1a 04/09/08 FW-0000080 0.0.1a 04/09/08 FW-0000081 0.0.1a 04/09/08 Bulk2: FW-0000078 0.0.1a 04/09/08 FW-0000080 0.0.1a 04/09/08 FW-0000081 0.0.1a 04/09/08	FRW=	FRW?	FRW={CR}Boot:{CR}abc{CR}Bulki:{CR}abc{CR}abc (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Global Amplifier Configuration	GAC=	43 bytes	Command or Query.
			Sets or returns the global status of the BUC/SSPA with a semicolon delimited string in the form a;b;cc.cc;dd.dd; e;fffff;g;hh;I;j;k;l;m;n;o where:
			    a = redundancy mode (ESW)
			    b = online status (ONL)
			    cc.cc = Attenuation Offset (AOF)
			    dd.dd = Customer Attenuation(ATT)
			    e = Auto Fault Recovery (AFR)
			    fffff = Unit Alarm Mask (MSK)
			    g = LNB Current Source (LCS)
			    hh = LNB Current Window (LCW)
			    i = LNB Current Window Enable (CWE)
			    j = Enable Statistics Averaging (ESA)
			    k = Set Statistics Interval (SSI)
			    l = Enable Statistics Logging (ESL)
			    m = Auxiliary Mute (AUX)
			    n = user mute state (MUT)
			    o = RF power amplifier state (AMP)
			
			Example (set GAC): GAC=a;b;cc.cc;dd.dd;e;fffff;g;hh;I;j;k;l;m;n;o;'cr'
				GAC=
				GAC*
				GAC?
				GAC#
					GAC?	GAC=x….x
						(See Description of Arguments)

Initialize Events Pointer	IEP=	None	Command only. Resets internal pointer to allow RNE? queries to start at the beginning of the stored events log. **Example:** <1/IEP='cr' >0001/IEP='cr'lf	IEP= IEP? IEP*	N/A	N/A

Software Image	IMG=	1 byte	Command or Query.
			Sets or returns the current active software image in the form x, where:
			    1=Bulk Image # 1 currently active
			    2=Bulk Image # 2 currently active
			
			Note: if you send the IMG command, and then query the IMG value the numbers may not be equal because the command tells the firmware which image to boot from at the next bootup, and the query reports the image that the firmware booted from on the last bootup.
			
			Examples:
			<1/IMG=1'cr' (instructs the unit to load firmware from image #1 at the next reset / power up).
			<1/IMG?'cr' (queries the image number that the firmware loaded during bootup)
				IMG=
				IMG?
				IMG*
				IMG#
					IMG?	IMG=x
						(See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

IP Address	IPA=	18 bytes	Command or Query.
			Sets or returns the IP address and network prefix for the 10/100 BaseT Ethernet management port, in the form xxx.xxx.xxx.xxx.yy, where:
			    xxx.xxx.xxx.xxx is the IP address, and
			    yy is the network prefix (8-30)
			
			Default value: 192.168.001.004.24
			
			Note: Changing the IP address through the Telnet interface requires the user to power cycle the unit, and then restart a new Telnet session with the new IP address. The IP address that you type into the Telnet client software does not include the range parameter so it would be: 192.168.1.4
			
			Example: <1/IPA=192.168.001.004.24'cr'
			>0001/IPA='cr''lf'
				IPA=
				IPA?
				IPA*
				IPA#
					IPA?	IPA=
						xx.xxx.xxx.xxx.yy
						
						(See Description of Arguments)

Gateway Address	IPG=	15 bytes	Command or Query. Sets or returns the Gateway IP address for the 10/100 Base Tx Ethernet management port, in the form xxx.xxx.xxx.xxx. **Default value**: 192.168.001.005 **Example**: <1/IPG=192.168.001.005'cr' >0001/IPG='cr''lf'	IPG= IPG? IPG*	IPG?	IPG = xxx.xxx.xxx.xxx
Initialize Statistics Pointer	ISP=	None	Command only. Resets internal pointer to allow RNS? queries to start at the beginning of the stored statistics log. **Example**: <1/ISP='cr' >0001/ISP='cr''lf'	ISP= ISP? ISP*	N/A	N/A

LNB Current Source	LCS=	1 byte	Command or Query.
			Sets or returns the LNB current source in the form x, where:
			    x= 0,1,2,3 or 4:
			        0 = Disable (**default value**)
			        1 = Enable (18V 22kHz Disabled – Note 2)
			        2 = 18V 22kHz Enabled (Note 2)
			        3 = 13V 22kHz Disabled (Note 2)
			        4 = 13V 22kHz Enabled (Note 2)
			
			Notes:
			 1) LCS must be enabled before the LNB current can be calibrated
			 2) This feature is available on multi-band units only.
			
			Example: <1/LCS=1'cr'
			>0001/LCS='cr''lf'
				LCS=
				LCS?
				LCS*
					LCS?	LCS=x
						(See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

LNB Current Window	LCW=	2 bytes	Command or Query.
			Sets or returns the alarm window in ±% of the calibrated LNB Current in the form xx, where:
			  xx=20 to 50, in increments of 1(%)
			    99 disables the alarm function (see **Note**)
			
			Default value: 30
			
			Note: When queried, a return value of 99 indicates that the current window is disabled. This method is due to become obsolete. Use of the CWE command/query is recommended instead of specifying 99 here.
			
			Example (sets the alarm window to ±30%): <1/LCW=30'cr'
			>0001/LCW='cr''lf'
				LCW=
				LCW?
				LCW*
					LCW?	LCW=xx
						(See Description of Arguments)

Retrieve next 5 unread Stored Alarms [E]	N/A	145 bytes	Query only.
			Returns the five oldest stored events in the alarm log. If there are no events in the log the unit will reply with LNA*. All events that are read from the log are also automatically removed from the log.
			Reply format:
			  YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			  YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			  YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			  YYYYYYYYYY ZZ mmddyy hhmmss'cr'
			  YYYYYYYYYY ZZ mmddyy hhmmss'cr''lf'
			Where:
			  YYYYYYYYYY = fault description.
			  ZZ = one of the following event types:
			    FT = Fault
			    OK = Clear
			    IF = Information
			  mmddyy hhmmss = date / time stamp.
			Example: <1/LNA?'cr'
			>0001/LNA='cr'
			LOG CLR IF 175503 052307'cr'
			FAN #1 FT 175504 052307'cr'
			OVR TMP FT 175504 052307'cr'
			FAN #1 OK 175504 052307'cr'
			IIC BUS FT 175504 052307'cr''lf'
				LNA=	LNA?	LNA=YY..ss
						(See Description of Arguments)

Low Power Forward Threshold	LPT=	5 bytes	Command or Query. Sets or returns the threshold for the low forward power alarm/fault in the form xx.xx. If the forward power drops below the specified value, the alarm/fault will be indicated. Setting this parameter to the **default value of 00.00** effectively disables the threshold **Example:** <1/LPT=00.00'cr' >0001LPT='cr''lf'	LPT = LPT? LPT *	LPT?	LPT =xx.xx (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Local/Remote State	LRS=	1 byte	Command or Query. Sets or returns Local or Remote state for Indoor SSPA (always in remote mode for Outdoor SSPA) in the form x, where x=0, 1, 2, or 3:: 　0 = Local 　1=Serial 　2=Ethernet 　3=Serial+Ethernet (**default value**) **Note:** The user will always have query access in any mode. The LRS command is also available in all modes as a means of acquiring control. The intent of this command is to limit changes from being made on multiple interfaces at the same time. Units without a front panel will treat an entry of 0 as reserved, and will refuse the command by returning a mode error. The web page GUI will refuse connections unless LRS is set to enable Ethernet remote control. **Example:** <1/LRS=3'cr' >0001/LRS='cr''lf'	LRS= LRS?	LRS?	LRS=x (See Description of Arguments)
Unit MAC Address	N/A	17 bytes	Query only. Returns the MAC address of the unit, in hexadecimal format xx-xx-xx-xx-xx-xx **Example:** <1/MAC?'cr' >0001/MAC=00-06-B0-00-D2-A7'cr''lf'	MAC=	N/A	MAC=xx-xx-xx-xx-xx-xx (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Maximum Operating point	N/A	272 bytes	Query only. Returns the maximum operating point of the unit along with its timestamp **Reply format:** MAXFET=sYYYC mmddyy hhmmss'cr' MINFET=sYYYC mmddyy hhmmss'cr' MAXPFT=sYYYC mmddyy hhmmss'cr' MAXDTP=sYYYC mmddyy hhmmss'cr' MAXHTS=sYYYC mmddyy hhmmss'cr' MINHTS=sYYYC mmddyy hhmmss'cr' MAXOST=sYYYC mmddyy hhmmss'cr' MAXRFP=sZZ.ZZ mmddyy hhmmss'cr' MINRFP=sZZ.ZZ mmddyy hhmmss'cr' Where: sYYYC is the temperature sZZ.ZZ is the power **Note**: not all LPODs have outside temperature monitor. In that case, MAXOST and MINOST will report XXXXX XXXXXX XXXXXX **Example:** <1/MOP?'cr' >0001/mop='cr' MAXFET=+000C 010208 180729'cr' MINFET=+000C 010208 180729'cr' MAXPFT=+000C 010208 180659'cr' MAXDTP=+000C 010208 180729'cr' MAXHTS=+050C 010208 180729'cr' MINHTS=+050C 010208 180729'cr' MAXOST=XXXXX XXXXXX XXXXXX'cr' MINOST=XXXXX XXXXXX XXXXXX'cr' MAXRFP=+00.00 010208 180659'cr' MINRFP=+00.00 010208 180659'cr'	MOP=	N/A	(See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Unit Alarm Mask	MSK=	5 bytes	Command or Query. Sets or returns alarm mask conditions in the form abcde, where: 0 = Fault, 1 = Alarm, 2 = Masked a = Low Forward RF Power b = External Reference Lock detect c = Fan Speed d = LNB Current Detect e = LNB 22V Power Supply Default value: 22111 **Example:** <1/MSK=22111'cr' >0001/MSK=1'cr''lf'.	MSK= MSK? MSK*	MSK?	MSK=abcde (See Description of Arguments)
Mute State	MUT=	1 byte	Command or Query. Sets or return the unit mute state in the form x, where: 0 = Disable (Not Muted) 1 = Enable (Muted) (**default value**) 2 = Unit muted due to AUX mute signal (see **Note**) **Note:** This value is only shown in the response to a query, and cannot be given as a command. When MUT returns a '2' it indicates that one of the "hardware" mute conditions is present. For example, an auxiliary mute could be present if the auxiliary mute has been enabled, and the signal to unmute the unit is not provided. Additionally, certain faults can generate a hardware mute such as the BUC lock detect, the LNB current draw (if enabled by the user), or the LNB voltage (if enabled by the user). If MUT returns an unexpected value of '2' then check the active faults and the status of the auxiliary mute. **Example:** <1/MUT=1'cr' >0001/MUT=1'cr''lf'	MUT= MUT? MUT*	MUT?	MUT=x (See Description of Arguments)
Number of Unread Stored Events	N/A	3 bytes	Query only. Returns the number, in the form xxx, of unread stored events **Example:** <1/NUE?'cr' >0001/NUE=126'cr''lf'	NUE=	NUE?	NUE=xxx
Number of Unread Stored Statistics	N/A	3 bytes	Query only. Returns the number, in the form xxx, of unread stored statistics **Example:** NUS=126	NUS=	NUS?	NUS=xxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Offline Mute	OFM=	1 byte	Command or Query. Sets or returns offline mute in the form x, where: 0 = Disable (Not Muted) 1 = Enable (Muted) 2 = Mute RX 3 = Mute Tx 4 = Mute Rx+LNB 5= Mute Tx+LNB **Note**: LNB Voltage of Online unit shows on Status page of Offline unit when Offline Mute is set to 4 or 5. This is caused by voltage feedback from Online unit to Offline unit via RF splitter. **Example:** <1/OFM=1'cr' >0001/OFM=1'cr''lf'	OFM= OFM?	OFM?	OFM=x
Online Status	ONL=	1 byte	Command or Query. Sets or returns the Redundancy Online status in the form x, where: 0 = Offline (Query only) (see **Note 2**) 1 = Online Notes: 1) The ONL query always returns an online response if the unit is not running in redundant mode. If redundancy is enabled then the query will indicate the position of the Tx waveguide switch that enables one of the units to be connected to the antenna. 2) Sending ONL=0 will not generate a syntax error; however setting ONL to zero will not cause the unit to go offline. The online status is determined by the TX waveguide redundant switch position, and only the offline unit may drive the switches. Instead of sending ONL=0 to the online unit the ONL=1 command should be sent to the offline unit to generate a redundant switchover. **Example:** <1/ONL=1'cr' >0001/ONL='cr''lf'	ONL= ONL? ONL*	ONL?	ONL=x
Part Number	N/A	Various 1-96 bytes	Query only. Returns the Comtech EF Data part number of the unit. This part number is the unit's DOTCODE at the time of manufacture. The DOTCODE may be up to 96 printable ASCII characters long. **Example:** <1/PNM?'cr' >0001/PNM=HPODC0.350WRSW00'cr''lf'	PNM=	PNM?	PNM=x....x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Retrieve Alarm Status	N/A	168 bytes	Query only.
			Returns the alarm status of the unit, where:
			   OK = no fault condition,
			   FT = faulted,
			   AL = alarm,
			   YS = Yes,
			   NO = No,
			   MS = masked,
			   ?? = invalid due to hardware failure,
			   NA = not applicable because hardware/options not installed.
			
			Example:
			<1/RAS?'cr'
			>0001/RAS='cr'
			P24V1=OK'cr' +24V power supply
			P24V2=OK'cr' +24V switch pwr supply
			LNBVT=OK'cr' +13/18V LNB power supply
			P13VT=OK'cr' +13.5V power supply
			P10V1=OK'cr' +10V power supply
			A10V1=OK'cr' +10V1 RF supply
			A10V2=OK'cr' +10V2 RF supply
			P7V8T=OK'cr' +7.8V power supply
			P5V8T=OK'cr' +5.8V power supply
			P2V5T=OK'cr' +2.5V power supply
			P1V2T=OK'cr' +1.2V power supply
			N5V8T=OK'cr' -5.8V power supply
			FANR1=OK'cr' Fan 1 speed
			FANR2=OK'cr' Fan 2 speed
			ATEMP=OK'cr' Amplifier temperature
			SHTDN=OK'cr' Over-temp shutdown
			IICST=OK'cr' I2C bus status
			FWPWR=OK'cr' Forward power in dBm
			CHKSM=OK'cr' Flash checksum
			FPGAD=OK'cr' FPGA done status
			BUCLD=OK'cr' BUC lock detect
			REFLD=OK'cr' Reference lock detect
			LNBCS=OK'cr' LNB current status
			SWITC=OK'cr' Waveguide switch position status
			RDLNK=OK'cr' Redundant link status
			TRMST=YS'cr''lf' Terminal Status
			
			Note: LNBVT, A10V1, A10V2, FANR1, FANR2, BUCLD, REFLD, LNBCS, SWITC and RDLNK will only appear in the list if the appropriate model / options have been selected / installed.
				RAS=	RAS?	RAS=x….x
						(See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Reboot	RBT=	1 byte	Command only. Performs a soft reboot in the form x, where: 　1 = Reboot System	RBT = RBT? RBT*	N/A	RBT=x (See Description of Arguments)
Retrieve Configuration Status	N/A	45 bytes	Query only. Returns the configuration status of the unit. **Examples:** RCS='cr' ATT=12.75'cr' AMP=1'cr' MUT=1'cr' ONL=1'cr' ESW=1'cr' AOF=00.00'cr' AFR=1'cr' XRF=N/A'cr''lf' (see **Note**) Where: ATT= attenuation in dB AMP= RF power amplifier state, 0=OFF, 1=ON MUT=RF mute state, 0=un-muted, 1=muted RED=Online status for redundancy ESW=Redundancy state and mode, 　states: 0=OFF, 1=ON Tx only, 2=ON Tx & Rx AOF=Attenuator Offset in dB AFR= auto fault recovery, 0=manual, 1=auto XRF = External reference status, N/A = no external reference, 05M for 5 MHz, and 10M for a 10 MHz **Note:** XRF will always be N/A if the internal reference oscillator option is **not** installed.	RCS=	RCS?	RCS=x....x (See Description of Arguments)
Online Status	RED=	1 byte	Command or Query. Sets or returns Redundancy Online status in the form x, where: 　0 = Offline 　1 = Online **Note**: this command is functionally identical to the ONL command. **Example:** <1/RED=1'cr' >0001/RED='cr''lf'	RED= RED? RED*	RED?	RED=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Reference Oscillator Tuning	REF=	3 bytes	Command or Query. Sets or returns the reference oscillator tuning voltage adjustment by sending a DAC value in the form xxx, where: xxx = is a numeric value from 0 to 255. **Default value:** 087 **Note:** This command sets the DAC value, but the actual Reference Oscillator tuning voltage can be monitored using the RMS command. **Example:** <1/REF=087'cr' >0001/REF='cr''lf'	REF= REF? REF*	REF?	REF=xxx (See Description of Arguments)
Retrieve Equipment Type [E]	N/A	22 bytes	Query only. Returns a string indicating the Model Number and the version of the M&C firmware installed in the unit. **Example:** <1/RET?'cr' >0001/RET=PS2053-5967-C REF BUC VER: 1.5.2'cr''lf'	RET=	RET?	RET=x….x (See Description of Arguments)
RF Power FET Current Status	N/A	variable length depending on the number of FETs installed in the RF amplifier	Query only. Returns all FET currents in the form xx.x when the value is >1 Amp, or xxx when the value is < 1 AMP **Example:** <1/RFS? 'cr' >0001/RFS='cr' Q01=.xxx'cr' Q02=.xxx'cr' Q03=xx.x'cr' Q04=xx.x'cr' Q05=xx.x'cr' Q06=xx.x'cr' Q07=xx.x'cr' Q08=xx.x'cr' Q09=xx.x'cr' Q10=xx.x'cr' Q11=xx.x'cr' Q12=xx.x'cr' Q13=xx.x'cr' Q14=xx.x'cr' Q15=xx.x'cr' Q16=xx.x'cr''lf'	RFS=	RFS?	RFS=x….x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Retrieve Maintenance Status	N/A	213 bytes, alpha-numeric	Query only. Returns maintenance status where: P24V1 = +24V power supply P24V2 = +24V switch power supply LNBVT = +13/18V LNB power supply (see **Note**) P13VT = +13.5V power supply P10V1 = +10V1 power supply A10V1 = 10V1 on RF Module A10V2 = 10V2 on RF Module (see **Note**) P7V8T = +7.8V power supply P5V8T = +5.8V power supply P2V5T = +2.5V power supply P1V2T = +1.2V power supply N5V8T = -5.8V power supply FANR1 = Fan 1 speed in percent FANR2 = Fan 2 speed in percent (see **Note**) BUCVT = BUC tuning voltage (see **Note**) FWPWR = Forward power in dBm REFVT = Reference osc. tuning voltage (see **Note**) LNBCS = LNB current supply in mA (see **Note**) ATEMP = Heatsink temperature in Celsius OTEMP = Outdoor temperature in Celsius (see **Note**) **Note:** LNBVT, FANR2, A10V2, BUCVT, REFVT, LNBCS, and OTEMP will appear if the appropriate options are installed; otherwise, the values will report XXXX. **Example:** <1/RMS?'cr' >0001/RMS='cr' P24V1=024.1'cr' P24V2=024.1'cr' LNBVT=018.2'cr' P13VT=013.4'cr' P10V1=010.1'cr' A10V1=010.1'cr' A10V2=010.1'cr' P7V8T=007.8'cr' P5V8T=005.8'cr' P2V5T=002.5'cr' P1V2T=001.2'cr' N5V8T=-05.7'cr' FANR1=100.0'cr' FANR2=100.0'cr' BUCVT=008.3'cr' FWPWR=+53.2'cr' REFVT=001.8'cr' LNBCS=380.2'cr' ATEMP=+40.0'cr' OTEMP=+25.0'cr'	RMS=	RMS?	RMS=x....x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Retrieve Next 5 Unread Stored Events	N/A	75 bytes	Query only.
			Returns the oldest 5 Stored Events which have not yet been read over the remote control in the format {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR} Sub-body{CR}Sub-body, where:
			    Sub-body= ABCCddmmyyhhmmss:
			    A being the fault/clear indicator.
			    F=Fault
			    C=Clear
			    I=Info
			    B being the fault type where:
			    1=Unit
			    2=RF
			    3=Log
			    CC is Fault Code numbers, as in RAS? or Info Code, which is:
			    0=Power Off
			    1=Power On
			    2=Log Cleared
			    3=Global Config Change
			    4=Redundancy Config Change
			RAS fault codes map as follows:
			    1) P24V1
			    2) P24V2
			    3) LNBVT
			    4) P13VT
			    5) A10V1
			    6) A10V2
			    7) 10VPS
			    8) P5V8T
			    9) P2V5T
			    10) P1V2T
			    11) N5V8T
			    12) P7V8T
			    13) FANR1
			    14) FANR2
			    15) ATEMP
			    16) SHTDN
			    17) IICST
			    18) FWPWR
			    19) CHKSM
			    20) FPGAD
			    21) BUCLD
			    22) REFLD
			    23) LNBCS
			    24) SWITC
			
			If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNE*. A Global Config Change is defined as any time a command is successfully executed. A query does not set the status change.
				RNE=	RNE?	RNE={CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss{CR}ABCCddmmyyhhmmss
						
						(See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Retrieve Next 5 Unread Stored Statistics	N/A	75 bytes	Query only.
			Returns the oldest 5 unread stored statistics entries in the reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where:
			  Sub-body= ddmmyyhhmmssaaa.abbb.bccc.cdd.ddefghhh.hiii.i
			  ddmmyy = day/month/year
			  hhmmss = hour:minute:second
			  aaa.a = Operating Temperature (I.E. +40.0)
			  bbb.b = Amp Temperature (I.E. +40.0)
			  ccc.c = RF Power output
			  dd.dd = Attenuation Setting
			  e = Amp On/Off
			  f = Mute On/Off
			  g = Online/Offline Status
			  hhh.h = LNB Current (mA)
			  iii.i = BUC Tuning Voltage
			
			If there are less than 5 entries to be retrieved, the remaining positions are padded with zeros. If there are no new entries, the response is RNS*.
				RNS=	RNS?	RNS={CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body
						
						(See Description of Arguments)

Serial Number [E]	N/A	9 bytes	Query only. Returns the unit's 9 digit serial number in the form of xxxxxxxxx. **Example:** <1/RSN?'cr' >0001/RSN=072282040'cr''lf'	RSN=	RSN?	RSN=xxxxxxxxx (See Description of Arguments)
Retrieve Utility Status	N/A	23 bytes, alpha- numeric	Query only. Returns the utility status of the unit. **Example:** <1/RUS='cr' >0001/RUS='cr' ADR=0001'cr' BDR=09600'cr' REF=087'cr''lf' (see **Note**) **Note:** REF will only appear if a reference oscillator is installed.	RUS=	RUS?	RUS=x….x (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
Remote Baud Rate	SBR=	4 bytes	Command or Query. Sets or returns the remote baud rate in the form xxxx, where: 2400 = 2400 baud 4800 = 4800 baud 9600 = 9600 baud (default value) 19K2 = 19200 baud 38K4 = 38400 baud Note: When changing baud rates remotely the response to the command will be returned using the same baud rate as that used to send the command. Examples: <1/SBR=9600'cr' >0001/SBR=9600'cr''lf' <1/SBR?'cr' >0001/SBR=09600'cr''lf'	SBR= SBR? SBR*	SBR?	SBR=xxxx (See Description of Arguments)

Switch Bias Tee	SBT=	1 byte numeric	Command or Query.
			Sets or returns switching of the bias tee into the through state or into the off state, in the form x, where:
			    0 = Off State (mute LNB) (default value)
			    1 = Through State (unmute LNB)
			
			Notes:
			1) The bias tee provides a means of muting the LNB. The SBT state will be controlled by the amplifier mute state while running in redundant mode, but while the unit is not in redundant mode the bias tee may be set independently of the amplifier mute state.
			2) To send this command the unit must have the bias tee option installed otherwise a mode error will result. A mode error will also result if this command is sent while the unit is running in redundant mode.
			
			Example: <1/SBT=1
				SBT=
				SBT?
				SBT*
					SBT?	SBT=x
						(See Description of Arguments)

Set FSK Address	SFA=	2 bytes, numeric	Command or Query. Sets or returns the FSK Address in the form xx, where: xx=01-15 Default value: 01 Example: <1/SFA=01'cr' >0001/SFA='cr''lf'	SFA = SFA? SFA*	SFA?	SFA=xx (See Description of Arguments)

Summary Fault Status [E]	N/A	1 byte	Query only.
			Returns the condition of the summary fault relay in the form x, where:
			    0 = Not Faulted (SumFLT_COM J6 pin K is not connected to SumFLT_NC J6 pin M)
			    1 = Faulted (SumFLT_COM J6 pin K is connected to SumFLT_NC J6 pin M)
			
			Example: <1/SFS?
			>0001/SFS=0'cr''lf'
				SFS=	SFS?	SFS=x
						(See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

SNMP Authentication Trap Enable	SNA=	1 byte	Command or Query.
			Sets or returns the SNMP Authentication in the form x, where:
			    0=Disabled
			    1=Enabled
			
			Example: <1/SNA=0
				SNA=
				SNA?
					SNA?	SNA=x
						(See Description of Arguments)

SNMP Enable	SNM=	1 byte	Command or Query.
			Sets or returns SNMP in the form x, where:
			    0=Disabled
			    1=Enabled
			Example: <1/SNM=0
				SNM=
				SNM?
					SNM?	SNM=x
						(See Description of Arguments)

Serial Number	N/A	9 bytes	Query only. Returns the unit's nine-digit serial number in the form xxxxxxxxx **Note**: this command is functionally identical to RSN. **Example:** <1/SNO?'cr' >0001/SNO=072282040'cr''lf'	SNO=	SNO?	SNO=xxxxxxxxx (See Description of Arguments)
Remote Address	SPA=	4 bytes	Command or Query. Sets or returns the Physical Address in the form xxxx, where: xxxx = 0001 to 9999, resolution=0001 **Default value:** 0001 **Example:** <1/SPA=0412'cr' >0001/SPA='cr''lf'	SPA= SPA? SPA*	SPA?	SPA=xxxx (See Description of Arguments)
SNMP Read Community	SRC=	16 bytes, characters, no spaces	Command or Query. Sets or returns the SNMP Read Community string. Empty string is not allowed **Example:** <1/SRC=public	SRC = SRC!	SRC?	SRC =x (see Description of Arguments))
SNMP System Contact	SSC=	255 bytes, characters,	Command or Query. Sets or returns the SNMP System Contact string. **Example:** <1/SSC=Joe Net Admin. If not configured it returns empty string: <1/SSC=	SSC = SSC!	SSC?	SSC =x [1..128] (see Description of Arguments)
Set Statistics Interval	SSI=	2 bytes	Command or Query. Sets or returns the interval at which statistics are logged, in the form xx, where: xx = 01 to 99 minutes, resolution is in 01 minute increments **Default value:** 90 **Example:** <1/SSI=90'cr' >0001/SSI='cr''lf'	SSI= SSI?	SSI?	SSI=xx (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)
SNMP System Location	SSL=	255 bytes, characters,	Command or Query. Sets or returns the SNMP System Location string **Example:** <1/SSL=Upstairs back right. **Note:** If not configured it returns empty string. <1/SSL=	SSL = SSL!	SSL?	SSL =x [1..128] (see Description of Arguments)
SNMP Unit Name	SSN=	16 bytes, characters,	Command or Query. Sets or returns the SNMP System Name string **Example:** <1/SSN=Remote1. **Note:** If not configured it returns empty string. <1/SSC=	SSN = SSN!	SSN?	SSN =x [1..128] (see Description of Arguments)
SNMP Trap Destination IP Address 1	STA=	15 bytes, Numerical	Command or Query. Sets or returns the IP address of the first SNMP Trap destination IP Address 1 where traps will be sent, in the form xxx.xxx.xxx.xxx **Example:** <1/STA=010.006.030.001 **Note:** When not configured, returns >0001/STA=0.0.0.0	STA = STA!	STA?	STA=xxx.xxx.xxx.xxx (see Description of Arguments)
SNMP Trap Destination IP Address 2	STB=	15 bytes, Numerical	Command or Query. Sets or returns the IP address of the first SNMP Trap destination IP Address 2 where traps will be sent, in the form xxx.xxx.xxx.xxx **Example:** <1/STB=010.006.030.001 **Note:** When not configured, returns >0001/STB=0.0.0.0	STB = STB!	STB?	STB=xxx.xxx.xxx.xxx (see Description of Arguments)

SNMP Trap Version	STV=	1 byte	Command or Query.
			Sets or returns the SNMP Trap Version that will be used to send traps.
			    1=SNMP Trap Version 1
			    2=SNMP Trap Version 2
			
			Example: <1/STV=0
				STV = STV!	STV?	STV =x (see Description of Arguments)

SNMP Write Community	SWC=	16bytes, characters, no spaces	Command or Query. Sets or returns the SNMP write community string. Empty string is not allowed **Example:** <1/SWC=private	SWC = SWC!	SWC?	SWC =x (see Description of Arguments)
Software Revision	N/A	34-37 bytes	Query only. Returns the value of the internal software revision installed in the unit, in the form: Boot:x.y.z Bulk1:x.y.z Bulk2:x.y.z -or- Boot:x.y.zz Bulk1:x.y.zz Bulk2:x.y.zz	SWR=	SWR?	SWR=Boot:x.y.zz Bulk1:x.y.zz Bulk2:x.y.zz (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Set RTC Time	TIM=	6 bytes	Command or Query.
			Sets or returns the real-time clock time, from midnight, in the form **hhmmss**, where:
			  hh = hours, from 00 to 23
			  mm = minutes, from 00 to 59
			  ss = seconds, from 00 to 59
			
			Example (time = 23 hours, 12 minutes and 59 seconds since midnight): <1/TIM=231259'cr'
			>0001/TIM='cr''lf'
				TIM =
				TIM?
				TIM *
					TIM?	TIM=xxxxxx
						(See Description of Arguments)

Temperature	N/A	5 bytes	Query only. Returns the temperatures of the Heatsink in the form of sxxxx, where: s = sign (+) or (-) xxxx = temperature. **Example:** <1/TMP=+26.0	TMP=	TMP?	TMP=sxxxx (See Description of Arguments)
Retrieve Number of Unread Stored Alarms[E]	N/A	2 bytes	Query only. Returns the number of stored alarms that remain unread in the alarm log, in the form xx. A maximum of 255 events may be stored in the alarm log. Numbers over 99 are reported as 99. **Example reply:** <1/TNA? 'cr' >0001/TNA=14'cr''lf'	TNA=	TNA?	TNA=xx (See Description of Arguments)
Retrieve Number of Unread Stored Events	N/A	2 bytes, numerical	Query Only. Returns the number of stored events that remain unread in the events logs, in the form xx. **Example:** <1/TNE? 'cr' >0001/TNE=18'cr''lf'	TNE=	TNE?	TNE=xx (See Description of Arguments)

Time Protocol Enable	TPE=	1 byte, numerical	Command or Query.
			Sets or returns the Time Protocol setting in the form x, where:
			  0 = Time protocol disabled
			  1 = Time protocol enabled
			
			Example (Time protocol enabled): <1/TPE=1'cr'
				TPE=
				TPE?
					TPE?	TPE=x
						(See Description of Arguments)

Time Protocol Server	TPS=	15 bytes, alpha-numeric	Command or Query. Sets or returns the Time Server IP address for the Unit Tx Ethernet management port, in the form xxx.xxx.xxx.xxx **Default value:** 255.255.255.255 **Example:** <1/TPS=192.168.001.005	TPS= TPS?	TPS?	TPS= xx.xxx.xxx.xxx.yy (See Description of Arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are printable ASCII characters)	Response to Command (Target to Controller)	Query (Instruction Code and Qualifier)	Response to Query (Target to Controller)

Terminal Status Change	N/A	1 byte	Query only.
			Indicates if there has been a change in the configuration since the last time a command was issued, in the form x, where:
			  0 = no status change
			  1 = there has been a status change.
			
			A status change is defined as any time a parameter is changed, such as when command that changes a value is successfully executed. A status change also results when there is a redundant switchover, or a fault condition. A query does not set the status change flag. The status change flag is cleared after being read.
			
			Example: <1/TSC?'cr'
			>0001/TSC=0'cr''lf'
				TSC=	TSC?	TSC=x
						(See Description of Arguments)

External Reference Mute^O	XRM=	1 byte numeric	Command or Query.
			Sets or returns the external reference mute state in the form x, where:
			  0 = Disable
			  1 = Enable (see **Note**)
			
			Note: To enable this command, the internal reference oscillator option must be installed; otherwise, a mode error will result. A hardware mute condition generated by the XRM mute is one of the conditions that can cause the MUT command to return MUT=2.
			
			When enabled, the unit will mute if an external reference oscillator is not detected.
			
			Example: <1/XRM=1'cr'
				XRM=
				XRM?
				MSK*
					XRM?	XRM=x
						(See Description of Arguments)

Appendix A. 1:1 REDUNDANCY

A.1   LPOD Redundancy Operation Overview

The LPOD Outdoor Amplifier / Block Up Converter can be used in a redundancy configuration by connecting the appropriate 1:1 Redundancy cable to the **'J6 | COM1'** Connector (see **Chapter 2. SYSTEM CONNECTIONS, INSTALLATION AND STARTUP**). Once the cable is attached, with the units placed in Redundancy Mode via the correct remote command the system automatically configures the backup (offline) unit by copying the configuration from the active (online) unit.

A.2   1:2 Redundancy Mode

1:2 Redundancy Mode is supported via an external controller box and is not addressed in this appendix.

A.3   1:1 Redundancy Mode

In 1:1 Redundancy Mode, the unit that is currently not the active (online) unit (as determined by the switch position) will be the controlling backup (offline) unit.

A.3.1   Ethernet-based Monitor and Control

See Chapter 4. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT for detailed information about using this interface.

Ethernet-based Remote Product Management/Monitor and Control (M&C) of any LPOD Standalone or 1:1 Redundancy application is available through use of the optional LPODnet M&C Netbook Accessory Kit (CEFD Kit KT-0000203). This kit provides the user with on-site access to the LPOD's remote Telnet, SNMP, or HTTP Web Server interfaces. For detailed information about this optional accessory, see the **LPODnet M&C Accessory for LPOD/SPOD PS 1, PS 1.5, PS 2 Operation Manual** (CEFD P/N MN-LPODNET).
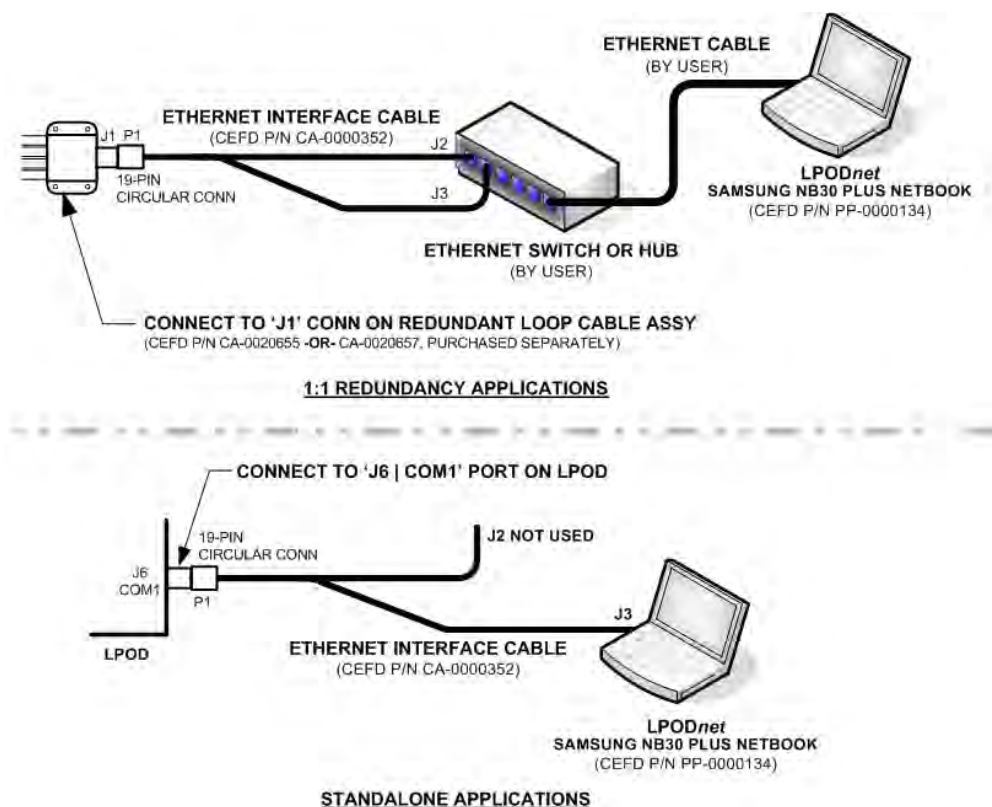
Figure A-1. Ethernet-based M&C using CEFD Kit KT-0000203

A.3.1.1   1:1 Redundant System Setup (Using a Single Ethernet Interface)

See Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for detailed information about the remote commands and queries specified in this section.

To set up a 1:1 Redundancy System using a single Ethernet interface, do these steps:

Step	Description
1	Turn both units off, and then connect them to the redundant system hardware using the proper cables.
2	Turn on Unit #2, and change its serial remote address from **1** (factory default) to a valid unique value (typically **2**) so that it does not conflict with any other unit in the system.
3	Change Unit #2's IP address from the factory default (**192.168.1.4/24**) to a valid unique value (typically **192.168.1.3/24**) so that it does not conflict with any other unit in the system.
4	Enable redundant mode by setting the **ESW** serial remote command (typically **ESW=1** or **ESW=2**). The waveguide switch / switches throw may be heard when redundant mode is enabled. Unit #2 is now the online unit.
5	Turn on Unit #1.
6	Change Unit #1's serial remote address / IP address if necessary (typically the factory default values are correct).
7	Enable redundant mode by setting the **ESW** command (typically **ESW=1** or **ESW=2**). The waveguide switch / switches throw may be heard when redundant mode is enabled. Unit #1 is now the online unit.
8	Set up all parameters for Unit #1 so that the configuration can be copied to Unit #2 (**AMP**, **MUT**, **ATT**, etc.).

A.3.2   Serial-based Monitor and Control

> **The EIA-232 Interface is not available for 1:1 Redundancy.**

> **See Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for detailed information about the remote commands and queries specified in this section.**

Serial-based Remote Product Management/Monitor and Control (M&C) of any LPOD Standalone or 1:1 Redundancy application is available through use of the optional CLC-10 Handheld Terminal M&C Accessory Kit (CEFD Kit KT-0020518). This kit provides the user with on-site access to the LPOD's serial remote control interface. For detailed information about this optional accessory, see the **CLC-10 Comtech LPOD Controller User's Guide** (CEFD P/N MN-CLC10).
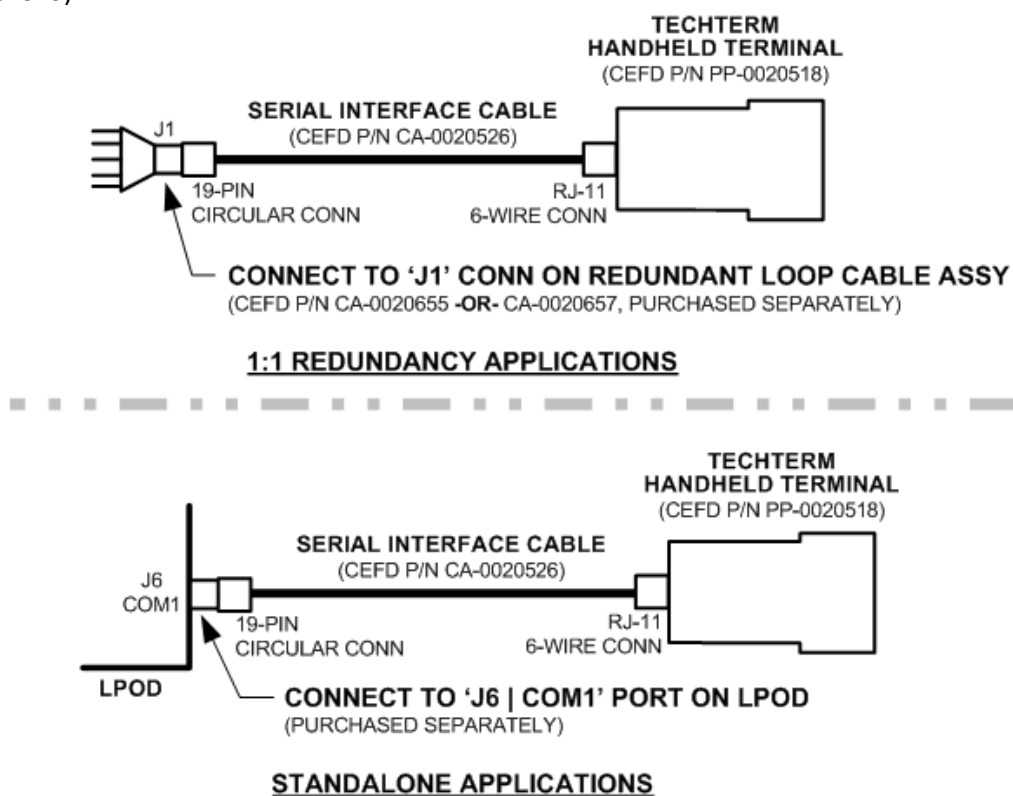
Figure A-2. Serial-based M&C using CEFD Kit KT-0020518

Serial command **ESW** determines system operation. If **ESW=1** (TX Only) or **ESW=2** (TX + RX) is executed in both units, the system will be in Automatic Redundancy mode. In this mode, if a fault is detected with the active (online) unit – either by loss of communications between the backup (offline) and active units, or via the summary fault – the backup unit will trigger the waveguide switch and, assuming the backup unit is not faulted, will become the active unit. The backup unit will also poll the active unit at regular intervals in an attempt to maintain configuration compatibility with the active unit; this ensures that, should a fault occur, the backup unit is configured exactly the same as the active unit.

The LPOD redundant mode does not specify which unit must be the backup (offline) unit. Instead, the status of the backup (offline) and active (online) units are determined by the waveguide switch position. The advantage to using this redundant method is that, after a failure is detected and the backup unit causes a redundant switchover to occur, the failed unit can be replaced without forcing a second switchover to occur. This is because the backup unit becomes the active unit, and when *another* unit is installed in the system it automatically becomes the *new* backup unit.

Redundant mode allows the backup (offline) unit to take control of the redundant system and force a redundant switchover when there is a problem with the active (online) unit. Currently, 1:1 redundancy is supported with either *transmit switching* or *transmit and receive switching*. The backup unit controls the waveguide switches and polls the active unit through the inter-unit redundant link, so that it will be ready to take over for the active unit if necessary.

Because the inter-unit redundant link uses the EIA-232 interface to communicate, the user remote commands to the redundant system must instead be sent through one of the other remote communications interfaces (i.e., EIA-485, Telnet, HTTP, or SNMP). The inter-unit redundant link is not used when the units are in manual redundant mode or when they are in standalone (redundancy disabled).

The following parameters are updated via the inter-unit redundant link (the equivalent remote command is shown in parentheses):

- Auto Fault Recovery (**AFR**)
- Amplifier state (**AMP**)
- Attenuation (**ATT**)
- Auxiliary Mute (**AUX**)
- LNB Current Window Enable (**CWE**)
- *Date (**DAY**)
- Enable Statistics Averaging (**ESA**)
- Enable Statistics Logging (**ESL**)
- LNB Current Source enable (**LCS**)
- LNB Current Window (**LCW**)

- Low Power Threshold (**LPT**)
- Local / Remote Setting (**LRS**)
- User fault mask (**MSK**)
- RF mute (**MUT**)
- Offline Mute (**OFM**)
- Remote LNB Control (**RLC**)
- Set Baud Rate (**SBR**)
- Set Statistics Interval (**SSI**)
- *Time (**TIM**)
- External Reference Mute (**XRM**)

> *** Day and Time are updated only when the inter-unit redundant link is either established or re-established.**

The **online status** of a unit in a redundant system is determined by the position of the Tx waveguide switch. When the Tx waveguide switch is oriented to allow a unit to send RF power to the antenna (as determined by the waveguide switch failsafe indicator), the unit is considered to be **online**. Otherwise, the unit is considered to be **offline**.

When redundant mode is disabled, the unit will always report that it is online. This is because standalone mode does not use the Tx waveguide switch position to determine online status,

since there are no waveguide switches monitored and controlled by the unit in standalone mode.

Only the offline unit is allowed to initiate a redundant switchover by throwing the waveguide switches. The offline unit will initiate a redundant switchover if any of the following conditions are met:

- Online unit faulted, and offline unit is not faulted.

- Inter-unit redundant link established, and then timed out.

- Mismatched waveguide switch condition is detected.

- Unit is forced online through a remote command.

If the unit has offline mute (**OFM**) enabled, then the unit will mute the RF output when it is offline. The **OFM** state also affects the bias tee switch position, because the bias tee switch serves as the unit's Rx path mute, so it is tied to the mute state (**MUT**) of the unit while the unit is running in redundant mode (i.e., if **MUT=1** then **SBT=0**, and if **MUT=0** then **SBT=1**). If the user tries to change the bias tee switch position while redundant mode is enabled a mode error will result.

A.3.2.1   Applicable Serial-Based Redundancy Commands and Queries

> **See Chapter 5. SERIAL-BASED REMOTE PRODUCT MANAGEMENT for detailed information about the remote commands and queries specified in this section.**

The serial remote commands and queries applicable to redundancy operations are as follows:

Remote Command	Meaning	Functional Description
RED	Redundancy Online/Offline	Reports the appropriate unit's online/offline status. Also used to force a unit to go active (online).
ESW	Enable Switch Mode	Puts the unit into redundancy or standalone (manual) mode.
AFR	Auto Fault Recovery	Sets the latching state of faults. Either they will latch to the faulted state or they will recover automatically.
AOF	Attenuation Offset	Individual attenuation command, used to adjust out small differences in power levels of different amplifier.

A.3.3   Troubleshooting Connectivity Issues

> **Each network is unique, and network configuration and management are outside the scope of this manual. This information is provided as a helpful troubleshooting tool, but trained network specialists may be required to make an Ethernet-enabled product work in a specific network. This section offers common solutions to network connectivity issues experienced by Comtech EF Data technical support personnel while developing or testing Ethernet-enabled products using the Windows XP operating system.**

The most common connectivity issue is neglecting to properly connect the LPOD to the external PC Ethernet interface.

Check for link and activity LEDs to light up on the NIC or network switch where the LPOD is connected to the Ethernet network. If the link LED is lit, validate the Ethernet connection by pinging the LPOD at its IP address using the Windows Command-line interface:

- To access the Command-line interface, click **Start → Run…** from the external PC's Taskbar.

- Type "**CMD**" (without the quotes) into the **Run** dialog box, and then click **OK**.

- At the Command-line prompt (typically **C:\>**), type "**ping 192.168.1.4**" (without the quotes).

If the IP address of the unit is not set to factory default (192.168.1.4), then use the unit's user-assigned IP address. If the ping command responds with the "**Request timed out.**" error message, then the LPOD cannot be seen by the computer. Otherwise, if there is a time listed in milliseconds, then the LPOD properly responded to the ping command and it is visible to the computer at the IP address that was pinged.

Another common connection problem is due to conflicts in the Address Resolution Protocol (ARP) table caused when a user connects two different pieces of hardware (with unique MAC addresses) to a single Ethernet port while both pieces of hardware are configured with the same Ethernet address.

This often happens when configuring new units set to the factory default IP address with a laptop that has a single Ethernet port (e.g., Comtech's LPOD*net* M&C Netbook Accessory product). If there are multiple units to be configured that are all set to the factory default IP address, then turn on one unit at a time, and reinitialize the Address Resolution Protocol (ARP) table each time a new unit is connected to the network as follows:

- First, check the values in the Address Resolution Protocol (ARP) table on the computer. This can be accomplished using the Windows Command-line interface:

  o To access the Command-line interface, click **Start → Run…** from the external PC's Taskbar.

  o Type "**CMD**" (without the quotes) into the **Run** dialog box, and then click **OK**.

- From the Command-line interface window, type "**ARP -a**" (without the quotes), and then press the Enter key.

- If the LPOD IP address is not displayed in the ARP table, then re-initialize the ARP table by typing "ARP -d" at the Command-line window prompt. The LPOD IP address should now be displayed when the ARP table is queried again.

- If the unit's IP address is still not shown and the ping test has failed, then verify the Ethernet settings of the unit using another remote control interface that is not dependant on the Ethernet port (e.g., EIA-485, EIA-232, or FSK).

A.4   1:1 Redundancy System Cabling and Installation

Figure A-3 shows the schematic diagram for cabling 1:1 Redundancy applications. For any 1:1 Redundancy System setup, care should be exercised in cable installation:

- Install the cables using the most direct route – avoid all sharp bends.

- Secure all cables with clamps and ties.

- Cable connectors used in outdoor applications – Type 'N' connectors and military style (MS) connectors in particular – must be sealed to avoid moisture seepage. Moisture can seep into junctions at the plug end of the connector, between the fixed and movable parts, and where the cable connects to the connector. In the presence of such seepage, signal attenuation and possible loss of signal can occur. Therefore, seal all cable junctions with a self-amalgamating tape, such as 3M Type 23 Scotch Self-Amalgamating tape, or equivalent.

For details about the cables used in both Standalone and 1:1 Redundancy applications, see **Appendix B. CABLE DRAWINGS**.
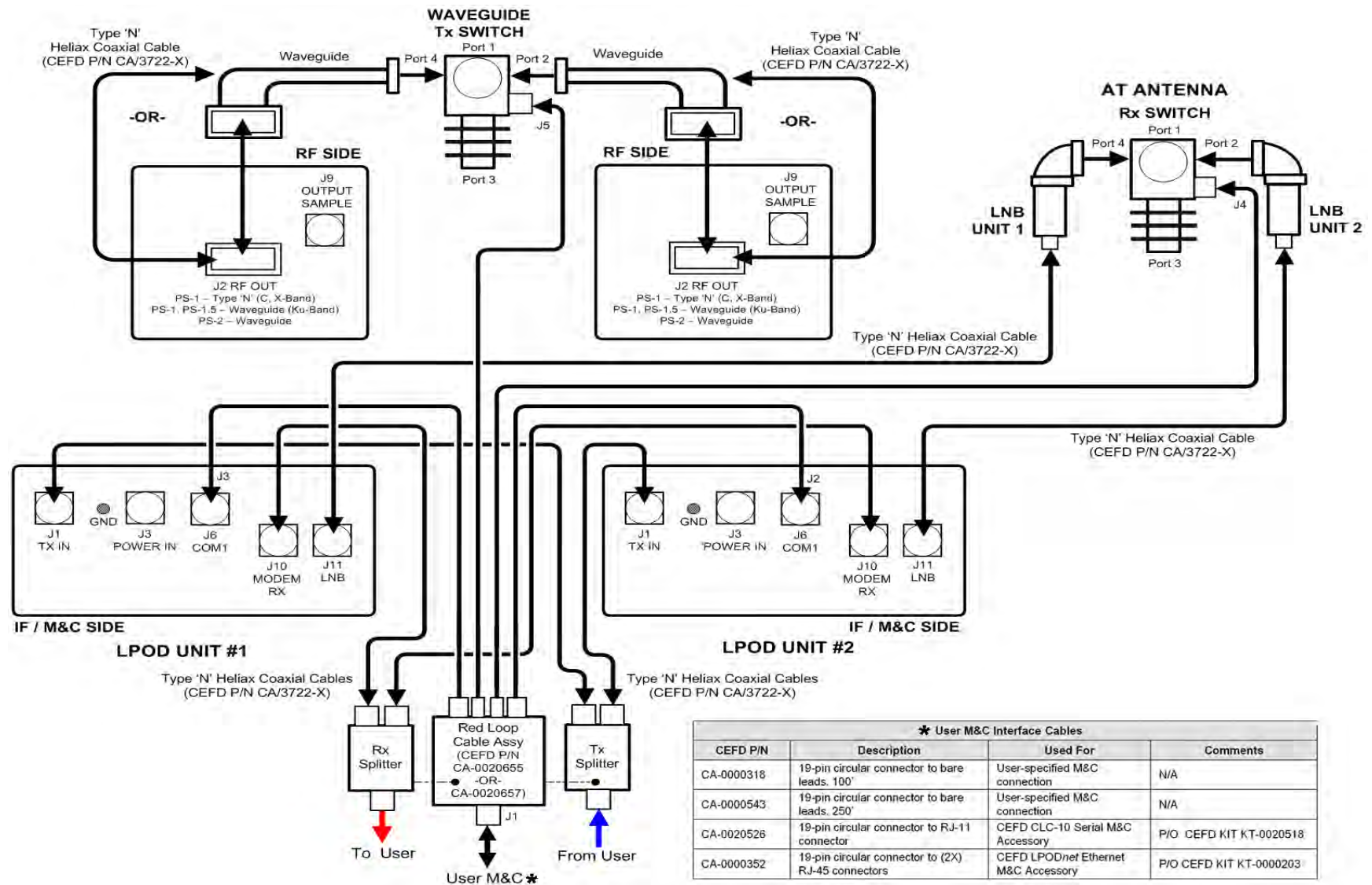
Figure A-3. Typical LPOD 1:1 Redundancy System Cabling Schematic

A.5   Redundancy System Assembly Kit Examples

Several kits are available from Comtech EF Data to mount and install standalone or redundant LPODs, depending on the type of unit ordered and its operational frequency.

> **The illustrations provided in this appendix are intended as reference examples only. The dimensions shown in these example figures are subject to change and may not reflect your installed configuration.**

The figures and tables provided in the subsections that follow illustrate the CEFD kits currently available for assembling LPOD PS 1, PS 1.5 or PS 2 1:1 Redundancy Systems. Unless otherwise noted, all 1:1 Redundancy Kit figures depict use of AC Option, Waveguide Output LPODs. Refer to **Chapter 2. SYSTEM CONNECTIONS, INSTALLATION AND STARTUP** for the available assembly kit options for LPOD Standalone configurations.

Sect. / Product	TABLE (Parts List)	FIGURE(S)	CEFD PART NO.	DESCRIPTION
A.5.1 Common Kits	N/A	A-4	KT-0020827	FREE STANDING 1:1 OR 1:2 UNISTRUT KIT
	N/A	A-5	KT-0000116	Rx SPLITTER & CABLES KIT
	A-1	A-6, A-7	KT-0000098	Rx SWITCH, LPOD C-BAND KIT
	A-2	A-8, A-9	PL/7596-1	Rx SWITCH, LPOD Ku-BAND KIT
	A-3	A-10, A-11	KT-0000191	Rx SWITCH, Ku-BAND, METRIC KIT
A.5.2 LPOD PS 1	A-4	A-12, A-13	KT-0000104	PS 1 C-BAND 1:1 KIT, MTG & CABLE, Tx SWITCH
	A-5	A-14, A-15	KT-0000090	PS 1 C-BAND COAX OUTPUT1:1 KIT, MTG & CABLE, Tx SWITCH
	A-6	A-16, A-17	KT-0000089	PS 1 Ku-BAND 1:1 KIT, MTG & CABLE, Tx SWITCH
	A-7	A-18 , A-19	KT-0000170	PS 1 X-BAND 1:1 KIT, MTG & CABLE, Tx SWITCH
A.5.3 LPOD PS 1.5	A-8	A-20 – A-22	KT-0020526	PS 1.5 C-BAND DC OPTION 1:1 KIT, MTG & CABLE, Tx SWITCH
	A-9	A-23, A-24	KT-0000060	PS 1.5 Ku-BAND 1:1 KIT, MTG & CABLE, Tx SWITCH
A.5.4 LPOD PS 2	N/A	A-25, A-26	KT-0020827	PS 2 C-BAND 1:1 FREE STANDING MOUNTING KIT
	A-10	A-27, A-28	KT-0000091	PS 2 C-BAND 1:1 KIT, MTG & CABLE, Tx SWITCH
	A-11	A-29, A-30	KT-0000254	PS 2 Ku-BAND 1:1 KIT, MTG & CABLE, Tx SWITCH

A.5.1   Common Kit Examples
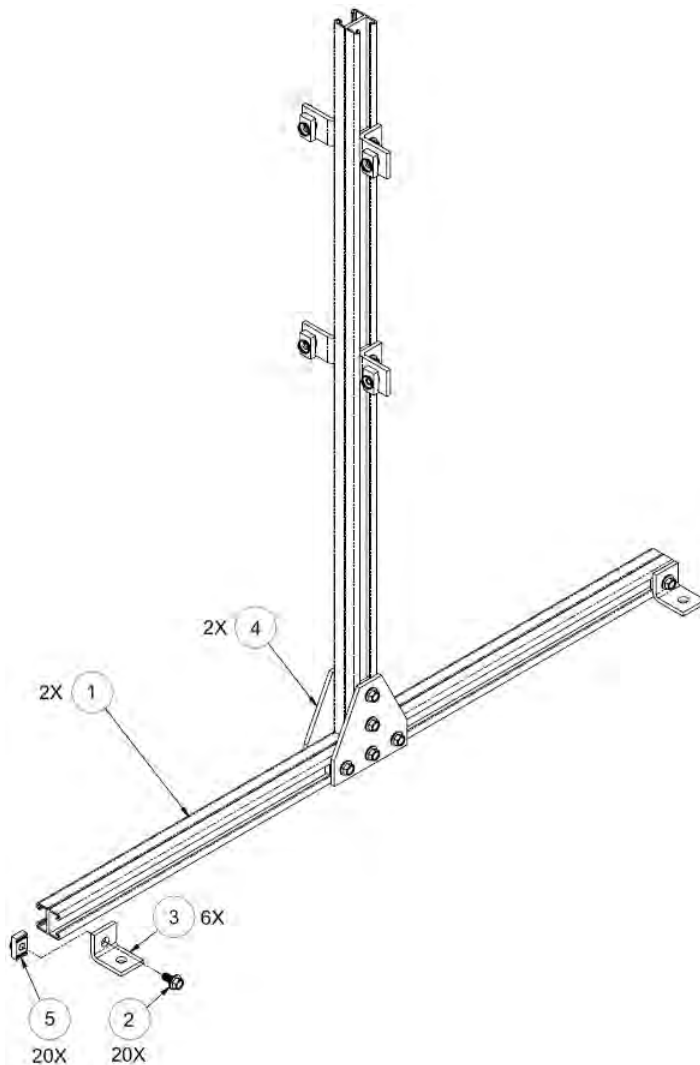
KT-0020827 FREE STANDING UNISTRUT KIT			
ITEM	QTY	CEFD P/N	DESCRIPTION
1	2	FP/BR11931-1	Bracket, Unistrut
2	20	HW-0000070	Screw, Hex, Flanged Head 0.3
3	6	HW-0020764	Bracket, Unistrut, 90°
4	2	HW-0020765	Bracket, Flat, Unistrut
5	20	HW/3/8SPRINGNUT	Springnut

Figure A-4. 1:1 or 1:2 Free Standing Unitstrut Kit (CEFD Kit KT-0020827)
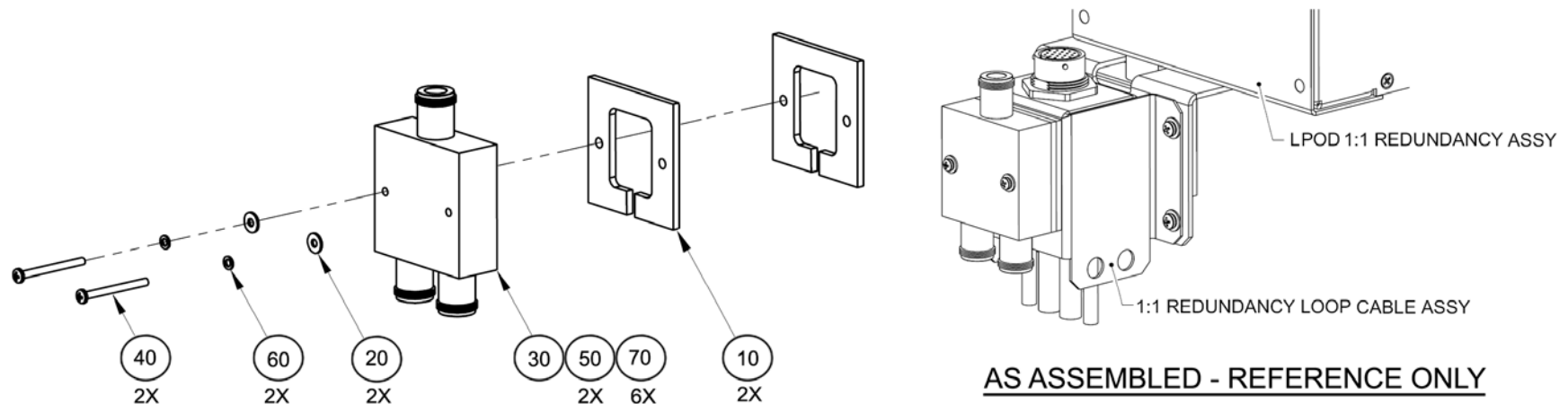
KT-0000116 LPOD RX SPLITTER / CABLE KIT			
ITEM	QTY	CEFD PART NO.	DESCRIPTION
10	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
20	2	HW/4-FLT	#4 FLAT WASHER, SS
30	1	RF-0000105	RF POWER SPLITTER/COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
40	2	HW/4-40X1.25PH	#4-40 x 1.25 LG PAN HD PHILLIPS SCREW, SS
50	2	CA/RF0097	CABLE ASSY, CONNECTOR, CSAT-7075 OUTPUT RF, ROHS
60	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
70	6	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK

Figure A-5. KT-0000116 LPOD Rx Splitter / Cable Kit Example – Exploded and Assembled Isometric Views

Table A-1. Parts List for KT-0000098 LPOD C-Band Rx Switch Kit

ITEM	QTY	CEFD PART NO.	DESCRIPTION
KT-0000098 LPOD C-BAND RX SWITCH KIT (AS PER FIGURE A-6)			
1	1	28P1084	QP RF ADAPTER, N (FEM) TO CPRG229 W/G GROOVED FOR 1/2 GASKET
2	1	CN/CX50NMALE	CONNECTOR, CN-50-OHM,N, MALE TERMINATION
3	1	SW/WGS28V-229SM	SWITCH, WAVEGUIDE, CPR229 GROOVED, +28V SEALED (MS3116F10-6S MATING CONN)
4	4	GA/GSKTCPR229FULL	GASKET, CPR229, FULL THK
5	12	03P1078	1/4-20 x 3/4 LG HEX BOLT, SS
6	32	HW/1/4-20X5/8HEX	1/4-20 x 5/8 LG HEX HD SCREW, SS
7	42	HW/1/4-FLT	1/4" FLAT WASHER
8	42	HW/1/4-SPLIT	1/4" SPLIT WASHER

Figure A-6. KT-0000098 LPOD C-Band Rx Switch Kit Example – Exploded Isometric View
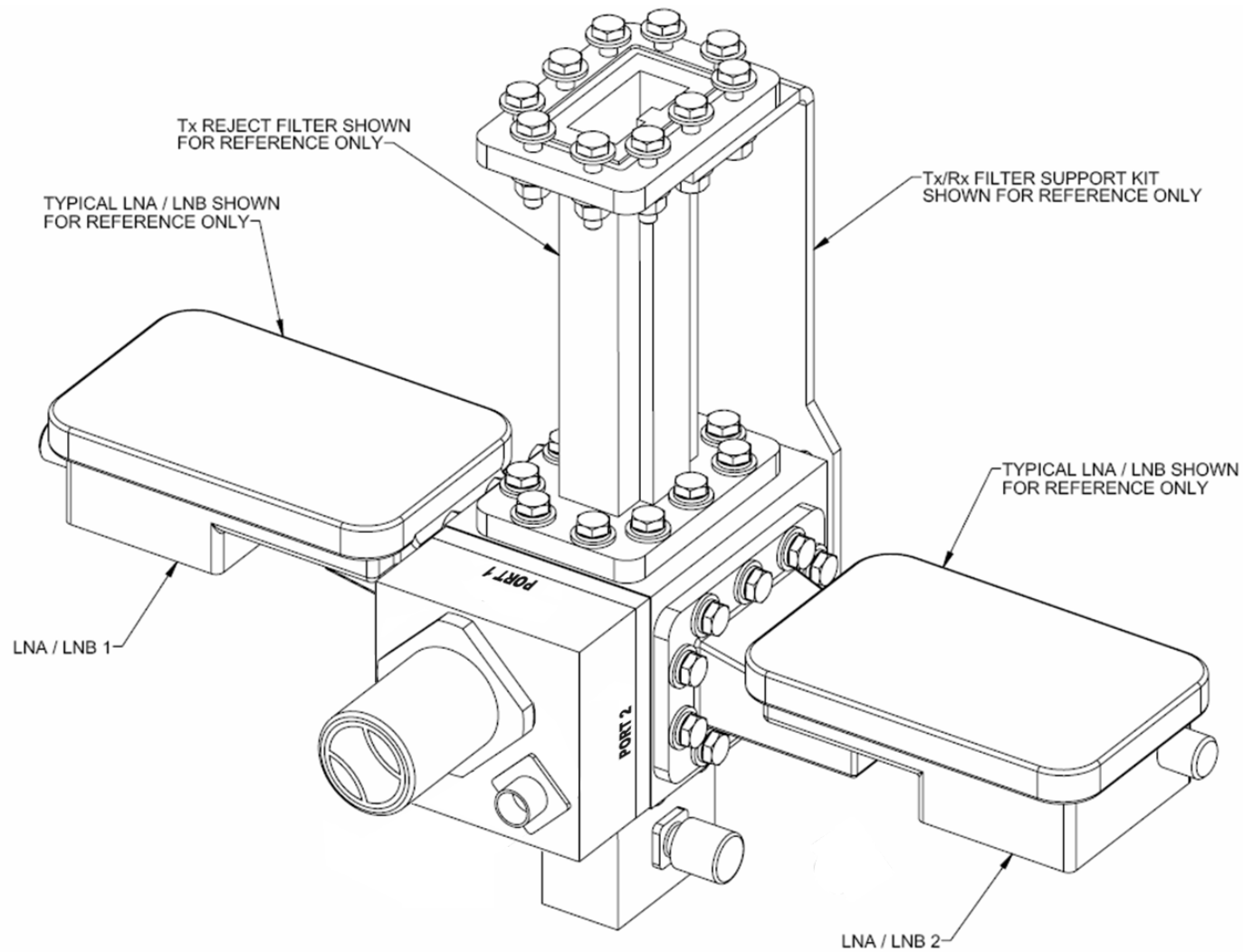
Figure A-7. KT-0000098 LPOD C-Band Rx Switch Kit Example – Assembled Isometric View

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Table A-2. Parts List for PL/7596-1 LPOD Ku-Band Rx Switch Kit

		PL/7596-1 LPOD KU-BAND RX SWITCH KIT (AS PER FIGURE A-8)	
ITEM	QTY	CEFD PART NO.	DESCRIPTION
1	1	SW/WGS28V-75SB	SWITCH, WAVEGUIDE, WR75, +28VDC, SEALED, SIDE & BOTTOM MNT
2	1	RF/TRF-KU-WR75G	RF TRANSMIT REJECT, WR75, GROOVED
3	7	GA/GSKTWR75HALF	GASKET, WR75, HALF THK
4	1	FP/6072	PLATE, SHORTING, WR75G
5	2	99D1483	ASSY, WAVEGUIDE WR75
6	24	HW/6-32X1/2SHCS	#6-32 x 1/2 LG SOCKET HD CAP SCREW, SS
7	12	HW/6-32X7/8SHCS	#6-32 x 7/8 LG SOCKET HD CAP SCREW, SS
8	28	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
9	40	HW/6-FLT	#6 FLAT WASHER, SS
10	12	HW/6-32HEXNUT	#6-32 HEX NUT, SS
11	3	HW-0000313	GASKET, WR75, FLAT, CONDUCTIVE

USE GASKETS (ITEMS 3 AND 11) AND HARDWARE
(ITEMS 6 THROUGH 10) SUPPLIED IN KIT TO
COMPLETE ASSEMBLY.

LNB UNIT 1

LNB UNIT 2

PORT 3

PORT 4
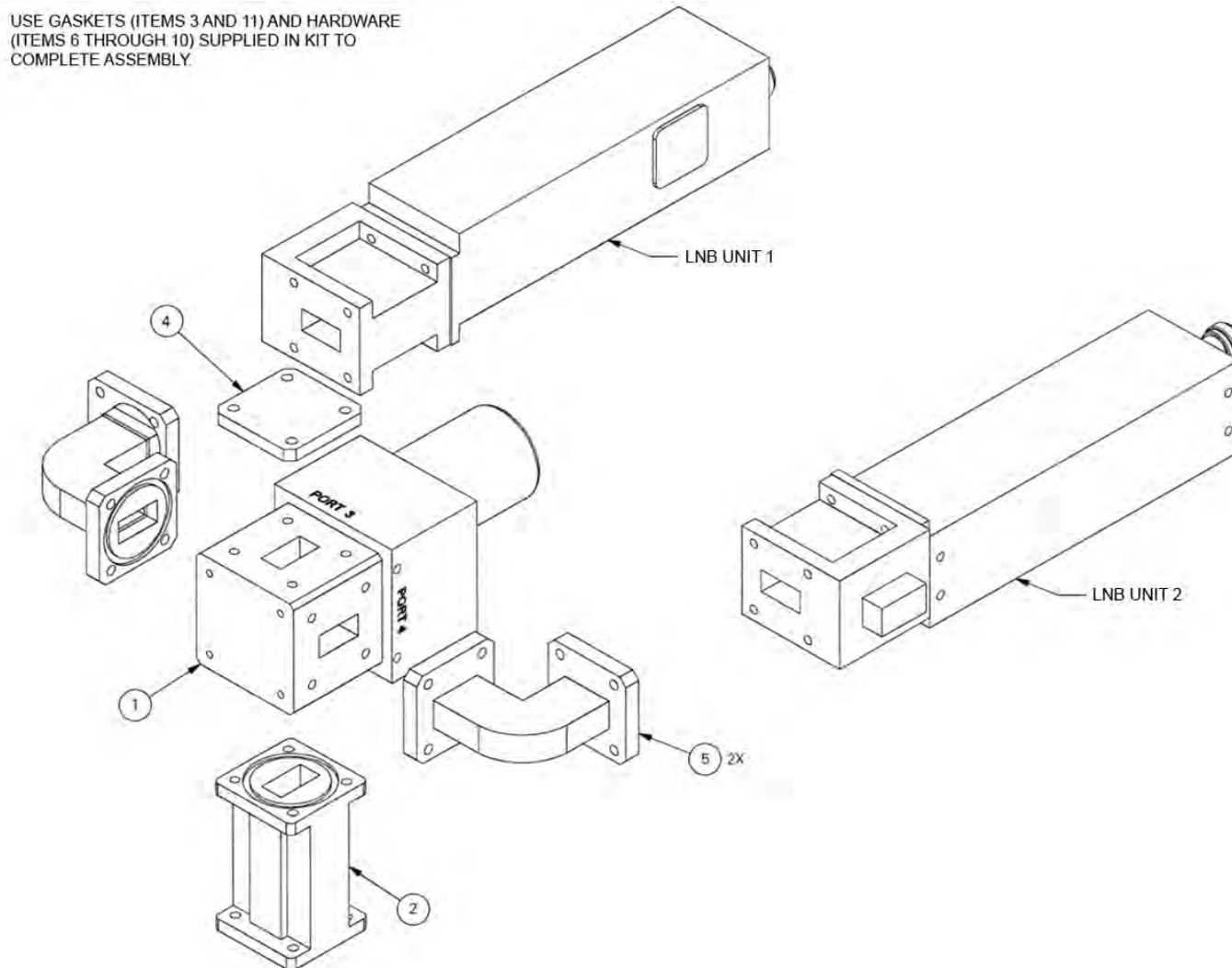
Figure A-8. PL/7596-1 LPOD Ku-Band Rx Switch Kit Example – Exploded Isometric View
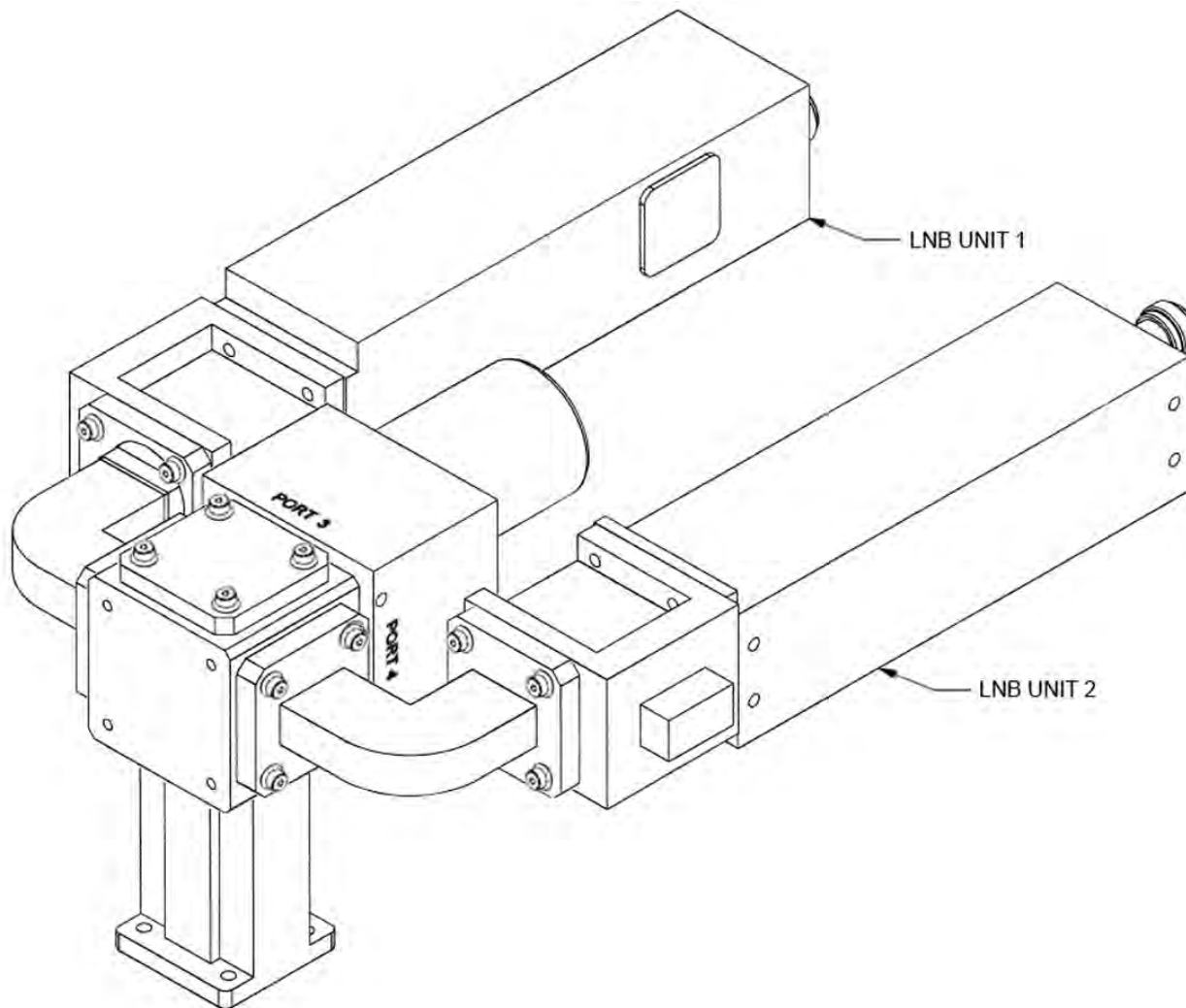
Figure A-9. PL/7596-1 LPOD Ku-Band Rx Switch Kit – Assembled Isometric View

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Table A-3. Parts List for KT-0000191 Ku-Band Rx Switch Kit, OMT-Mounted, Metric

ITEM	QTY	CEFD PART NO.	DESCRIPTION
		KT-0000191 KU-BAND RX SWITCH KIT (AS PER FIGURE A-10)	
1	1	SW/WGS28V-75SB	SWITCH, WAVEGUIDE, WR75, +28VDC, SEALED, SIDE & BOTTOM MNT
2	1	RF/TRF-KU-WR75G	RF TRANSMIT REJECT, WR75, GROOVED
3	7	GA/GSKTWR75HALF	GASKET, WR75, HALF THK
4	1	FP/6072	PLATE, SHORTING, WR75G
5	2	FP-0001006	WAVEGUIDE, WR-75, 90-DEG ELB, #6/M4 FLANGE CLEARANCES
6	16	HW/6-32X1/2SHCS	#6-32 x 1/2 LG SOCKET HD CAP SCREW, SS
7	4	HW/6-32X7/8SHCS	#6-32 x 7/8 LG SOCKET HD CAP SCREW, SS
8	20	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
9	24	HW/6-FLT	#6 FLAT WASHER, SS
10	4	HW/6-32HEXNUT	#6-32 HEX NUT, SS
11	3	HW-0000313	GASKET, WR75, FLAT, CONDUCTIVE
12	8	HW/M4LOCK	M4 SPLIT LOCK WASHER, SS
13	16	HW/M4FLAT	M4 FLAT WASHER, SS
14	8	HW/M4X.07HEX	M4 x .07 HEX HUT, SS
15	8	HW/M4X12SHCS	M4 x 12 LG SOCKET HEAD CAP SCREW, SS
16	8	HW/M4X25SHCS	M4 x 25 LG SOCKET HEAD CAP SCREW, SS

Figure A-10. KT-0000191 Ku-Band Rx Switch Kit Example, OMT-Mounted, Metric – Exploded Isometric View

Figure A-11. KT-0000191 Ku-Band Rx Switch Kit Example, OMT-Mounted, Metric – Assembled Isometric View

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A.5.2   LPOD PS 1 1:1 Redundancy Kit Examples

Table A-4. Parts List for KT-0000104 LPOD PS 1 1:1 Redundancy Kit

ITEM	QTY	CEFD PART NO.	DESCRIPTION

KT-0000104 LPOD PS 1 C-BAND 1:1 REDUNDANCY KIT (AS PER FIGURE A-12)			
ITEM	QTY	CEFD PART NO.	DESCRIPTION
1	4	FP-0000534	BRACKET, MOUNTING, LPOD PS 1
2	2	FP-0000542	CHANNEL, DUAL, UNISTRUT, 1:1 RDNT, LPOD PS 1
3	1	FP-0000537	BRACKET, UNIVERSAL, 1:1 RDNT, LPOD PS 1
5	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
6	1	FP-0000645	BRACKET, SUPPORT, 1:1 RED., LPOD PS 1
10	2	CA/RF0097	CABLE ASSY, ROHS CONNECTOR, CSAT-7075 OUTPUT RF
11	1	HW/CAP-SS14	DUST COVER, RECEPTACLE W/CHAIN & RING, NON-SHORTING, SIZE 14, SS
12	2	CA/6357-2	CABLE, ROHS TX (2FT)
20	1	SW/WGS28V-137S	SWITCH, WAVEGUIDE, CPR137, +28V SEALED
21	1	FP/WG0034	PNQ, WAVEGUIDE TERMINATION, SMALL FINS
22	1	RF-0000105	RF POWER SPLITTER/COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
23	4	GA/CPR-137-R-H-C	GASKET, D SHAPE, CPR-137, HALF THICKNESS, CONDUCTIVE
24	2	FP/5683	WELDMENT, WAVEGUIDE ADAPTER CPRG137 TO N
30	8	HW/1/4-20X1/2FH	1/4-20 x 1/2 LG FH PHILLIPS SCREW, 82°, UCUT, SS
31	10	HW-0000070	3/8-16 x 3/4 LG SERR HD FLNG HEX SCREW
32	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
33	2	HW/4-40X1.38PH	#4-40 x 1-3/8 LG PHILLIPS HD SCREW, SS
34	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
35	2	HW/4-FLT	#4 FLAT WASHER, SS
37	4	HW/6-32X5/16P.H	#6-32 x 5/16 LG PHILLIPS HD SCREW, SS
38	4	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS S
39	4	HW/6-FLT	#6 FLAT WASHER, SS
40	26	HW/#10-32X1/2SH	#10-32 x 1/2 LG SOCKET HD CAP SCREW
41	14	HW/#10-32X5/8SHC	#10-32 x 5/8 LG SOCKET HD CAP SCREW
42	32	HW/10-SPLIT	#10 SPLIT LOCK WASHER, SS
43	32	HW/10-FLT	#10 FLAT WASHER, SS
49	12	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK
50	2	HW/8-32X1/2SHCS	#8-32 x 1/2 LG SOCKET HD CAP SCREW, SS
51	4	HW/8-FLT	#8 FLAT WASHER, SS
52	2	HW/8-SPLIT	#8 SPLIT LOCK WASHER, SS
53	2	HW/8-32HEXNUT	#8-32, HEX NUT, SS

Figure A-12. KT-0000104 LPOD PS 1 C-Band 1:1 Redundancy Kit Example – Exploded Isometric View
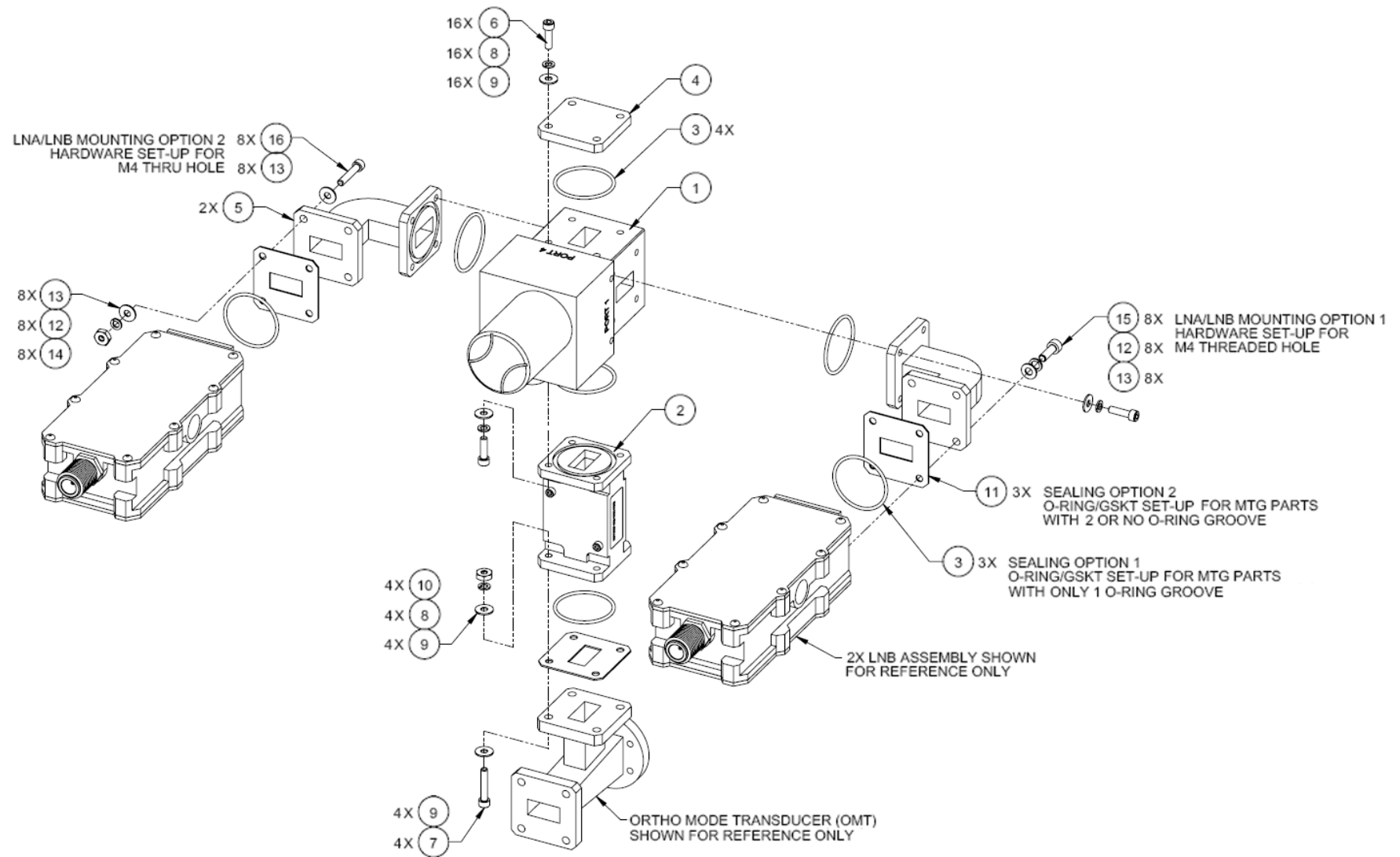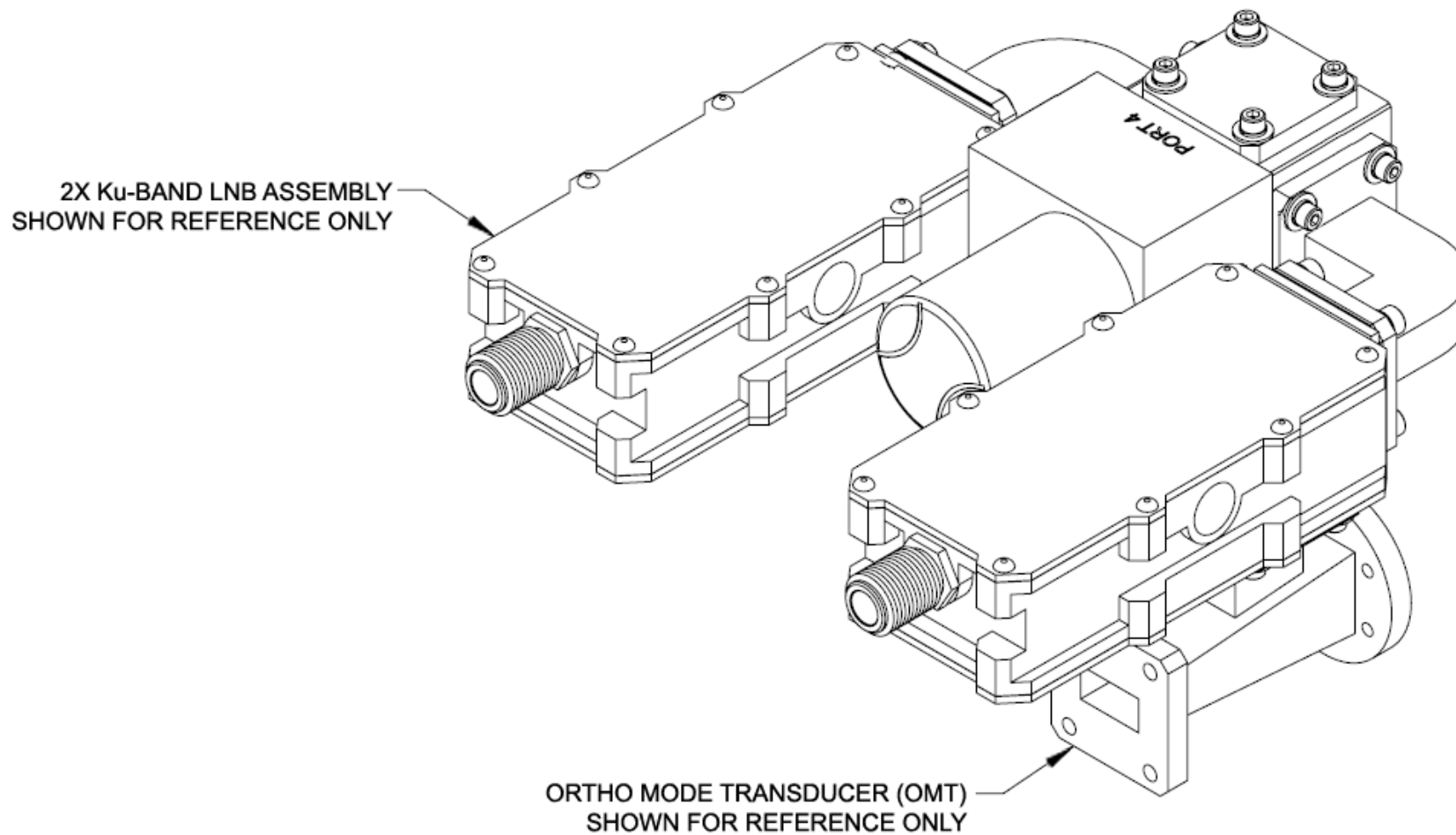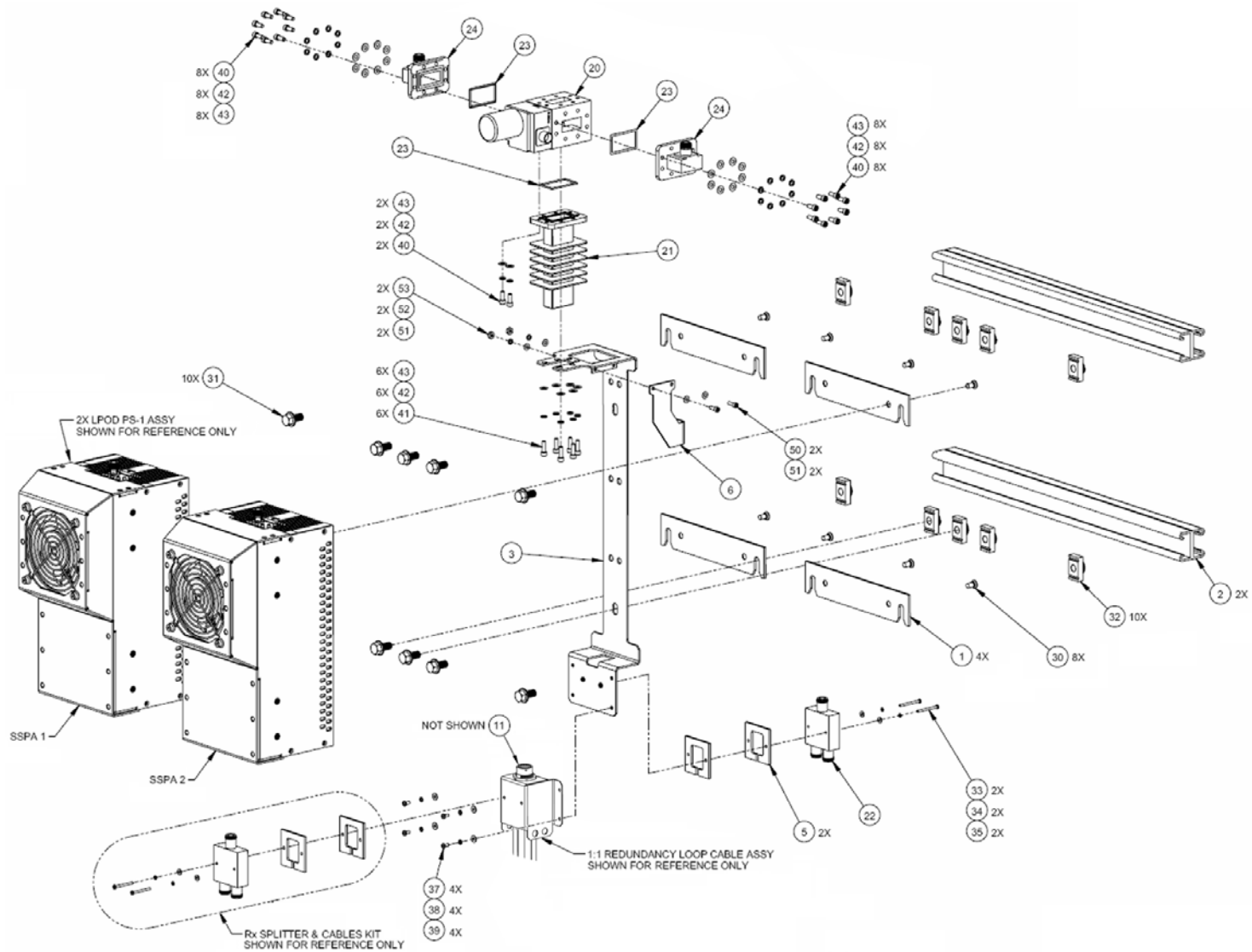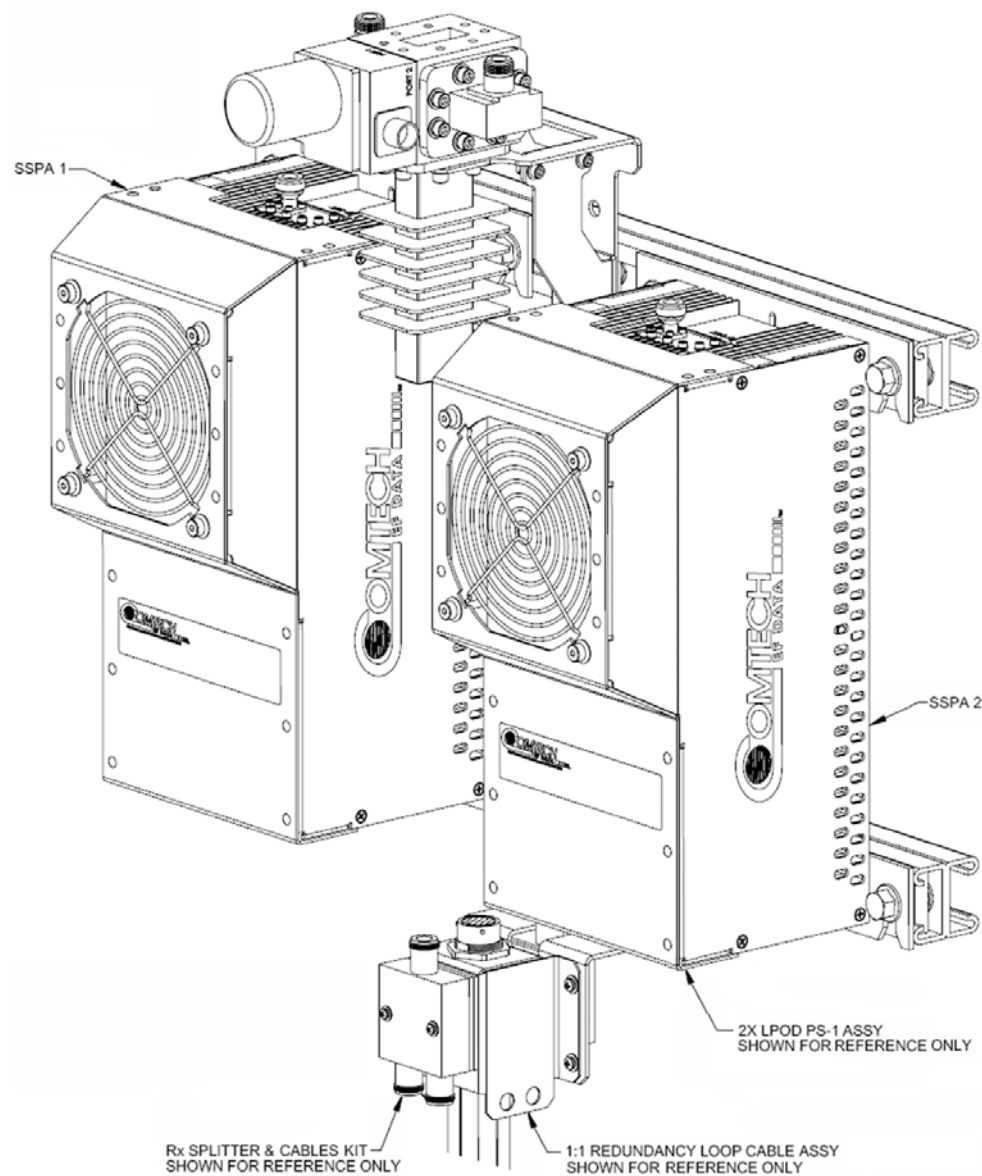
Figure A-13. KT-0000104 LPOD PS 1 C-Band 1:1 Redundancy Kit Example – Assembled Isometric View

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Table A-5. Parts List for KT-0000090 LPOD PS 1 C-Band Coax Output 1:1 Redundancy Kit

| ITEM	QTY	CEFD PART NO.	DESCRIPTION
KT-0000090 LPOD PS 1 C-BAND COAX OUTPUT 1:1 REDUNDANCY KIT (AS PER FIGURE A-14)			
1	4	FP-0000534	BRACKET, MOUNTING, LPOD PS 1
2	2	FP-0000542	CHANNEL, DUAL, UNISTRUT, 1:1 RDNT, LPOD PS 1
3	1	FP-0000537	BRACKET, UNIVERSAL, 1:1 RDNT, LPOD PS 1
5	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
10	4	CA/6357-2	CABLE, ROHS, TX, 2FT
11	1	HW/CAP-SS14	DUST COVER,RECEPTACLE,NON-SHORTING,SIZE 14,SS,W/CHAIN & RING
20	1	SW/COAX-N-F-SEALED	SWITCH COAX N-FEMALE, 25VDC 5.9-6.5 SEALED
21	1	RF-0000104	TERMINATION, MOD, TYPE N, M, 50 W, DC-8.5 GHz
22	1	RF-0000105	SPLITTER/COMBINER, RF POWER, 2-WAY, 0 DEGREES, 1-2GHZ
30	8	HW/1/4-20X1/2FH	1/4-20 x 1/2 LG FH PHILLIPS SCREW, 82, UCUT, SS
31	10	HW-0000070	3/8-16 x 3/4 LG HEX, FLNG, SERR SCREW, SS
32	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
33	2	HW/4-FLT	#4 FLAT WASHER, SS
34	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
35	2	HW/4-40X1.38PH	#4-40 x 1/38 P.H. PHIILIPS SCREW, SS
37	4	HW/6-FLT	#6 FLAT WASHER, SS
38	4	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
39	4	HW/6-32X5/16P.H	#6-32 x 5/16 LG PHILLIPS SCREW
40	2	HW-0000170	M4X0.7 x 8 LG PAN HD PHILLIPS SCREW, SS
41	2	HW/M4LOCK	M4 LOCK WASHER, SS
42	2	HW/M4FLAT	M4 FLAT WASHER, SS
43	12	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK
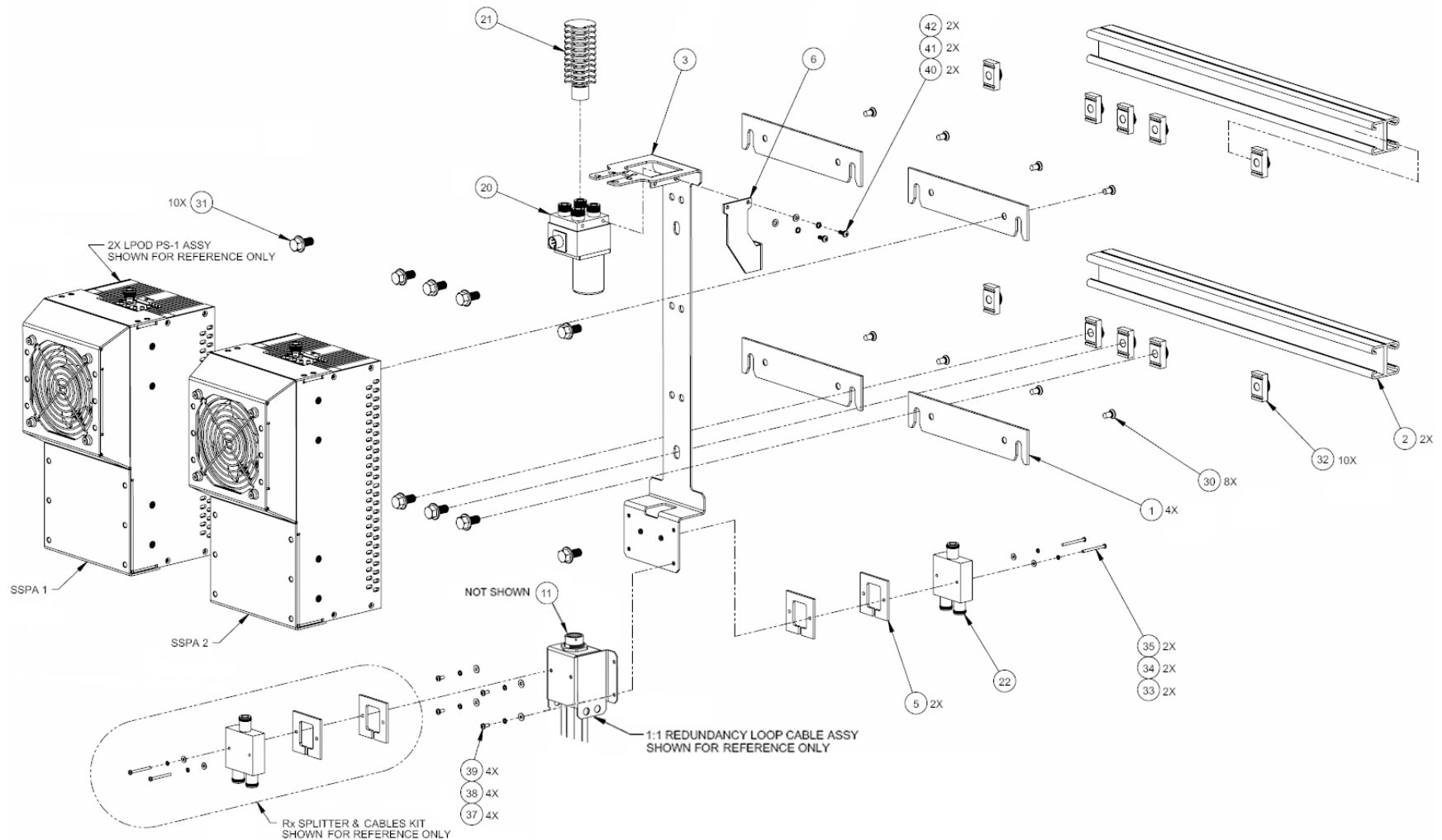
Figure A-14. KT-0000090 LPOD PS 1 C-Band Coax Output 1:1 Redundancy Kit Example – Exploded Isometric View
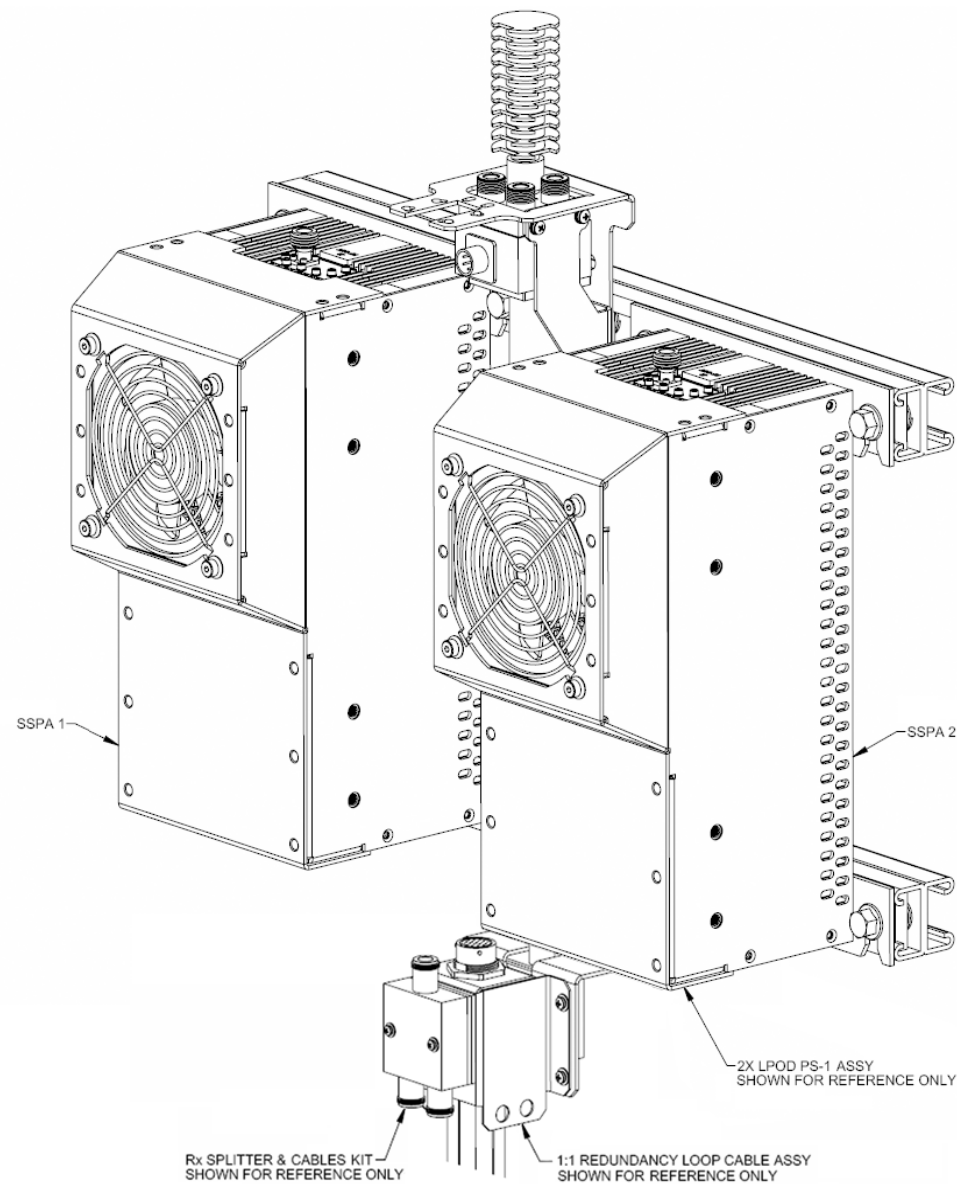
Figure A-15. KT-0000090 LPOD PS 1 C-Band Coax Output 1:1 Redundancy Kit Example – Assembled Isometric View

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Table A-6. Parts List for KT-0000089 LPOD PS 1 Ku-Band 1:1 Redundancy Kit

ITEM	QTY	CEFD PART NO.	DESCRIPTION
KT-0000089 LPOD PS 1 KU-BAND 1:1 REDUNDANCY KIT (AS PER FIGURE A-16)
1	4	FP-0000534	BRACKET, MOUNTING, LPOD PS 1
2	2	FP-0000542	CHANNEL, DUAL, UNISTRUT, 1:1 RDNT, LPOD PS 1
3	1	FP-0000537	BRACKET, UNIVERSAL, 1:1 RDNT, LPOD PS 1
4	1	FP-0000548	WAVEGUIDE, Ku, WR-75, GRVD FLGS, E TO H TO FLEX, LH, 1:1, PS 1
5	1	FP-0000549	WAVEGUIDE, Ku, WR-75, GRVD FLGS, E TO H TO FLEX, RH, 1:1, PS 1
7	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
8	1	FP-0000645	BRACKET, SUPPORT, 1:1 RED., LPOD PS 1
11	2	CA/RF0097	CABLE ASSY, ROHS CONNECTOR, CSAT-7075 OUTPUT RF, ROHS
12	1	HW/CAP-SS14	DUST COVER,RECEPTACLE,NON-SHORTING,SIZE 14,SS,W/CHAIN & RING
20	1	SW/WGS28V-75SB	SWITCH, WAVEGUIDE, WR75, +28VDC, SEALED, SIDE & BOTTOM MNT
21	1	RF/TERM-11923-5	RF TERMINATION, WR75G, 14-14.5GHz, 1.05:1 VSWR, 150W
22	1	RF-0000105	RF POWER SPLITTER/COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
23	6	GA/WR75-R-H-C	GASKET, O RING, WR-75, HALF THICKNESS, CONDUCTIVE
24	12	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK
30	8	HW/1/4-20X1/2FH	1/4-20 x 1/2 FLAT HD PHILLIPS SCREW, 82°, UCUT, SS
33	10	HW-0000070	3/8-16 x 3/4 LG SCREW, HEX, FLNG, SERR, SS
34	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
35	2	HW/4-FLT	#4 FLAT WASHER, SS
36	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
37	2	HW/4-40X1.38PH	#4-40 x 1-3/8 LG PAN HD PHILLIPS SCREW, SS
39	28	HW/6-FLT	#6 FLAT WASHER, SS
40	28	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
41	4	HW/6-32X5/16P.H	#6-32 x 5/16 LG PHILLIPS SCREW
42	20	HW/6-32X1/2SHCS	#6-32 x 1/2 LG SOCKET HD CAP SCREW, SS
43	4	03P1111	#6-32 x 9/16 LG SOCKET HD SCREW, SS
44	2	HW/8-32X1/2SHCS	#8-32 x 1/2 LG SOCKET HD CAP SCREW, SS
45	4	HW/8-FLT	#8 FLAT WASHER, SS
46	2	HW/8-SPLIT	#8 SPLIT LOCK WASHER, SS
47	2	HW/8-32HEXNUT	#8-32 HEX NUT, SS

Figure A-16. KT-0000089 LPOD PS 1 Ku-Band 1:1 Redundancy Kit Example – Exploded Isometric View

SSPA 1

SSPA 2

2X LPOD PS-1 ASSY
SHOWN FOR REFERENCE ONLY

Rx SPLITTER & CABLES KIT
SHOWN FOR REFERENCE ONLY

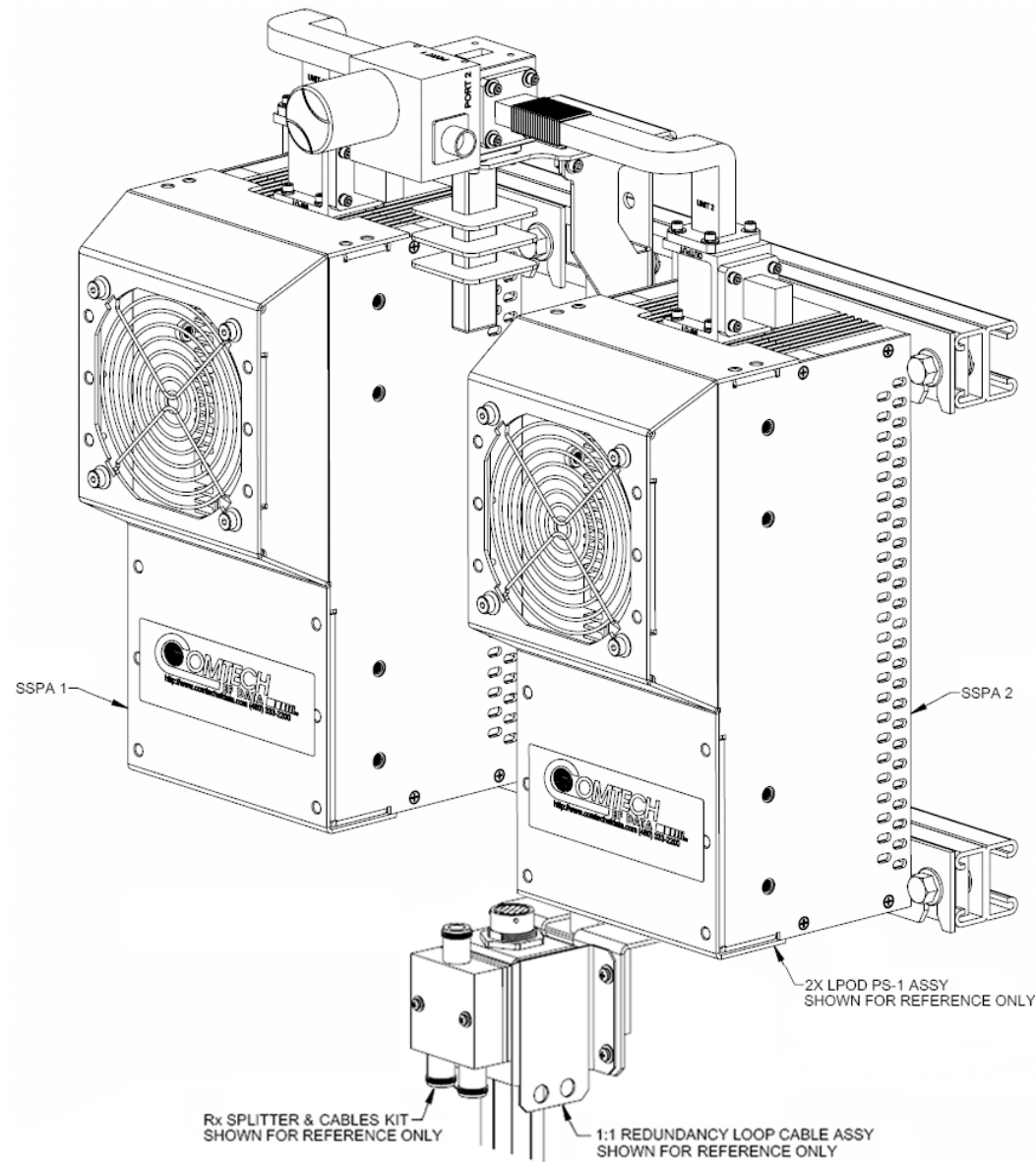1:1 REDUNDANCY LOOP CABLE ASSY
SHOWN FOR REFERENCE ONLY

Figure A-17. KT-0000089 LPOD PS 1 Ku-Band 1:1 Redundancy Kit Example – Assembled Isometric View

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Table A-7. Parts List for KT-0000170 LPOD PS 1 X-Band 1:1 Redundancy Kit

| ITEM	QTY	CEFD PART NO.	DESCRIPTION
KT-0000170 LPOD PS 1 X-BAND 1:1 REDUNDANCY KIT (AS PER FIGURE A-18)			
0	2	CA-0000348	CABLE ASSY, RF, 2 FT
0	12	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK
1	4	FP-0000534	BRACKET, MOUNTING, LPOD PS 1
2	2	FP-0000542	CHANNEL, DUAL, UNISTRUT, 1:1 RDNT, LPOD PS 1
3	1	FP-0000537	BRACKET, UNIVERSAL, 1:1 RDNT, LPOD PS 1
4	1	FP-0000948	WAVEGUIDE, PREFORMED SEAMLESS FLEX, X, CPRG-112, LH, 1:1, PS 1
5	1	FP-0000949	WAVEGUIDE, PREFORMED SEAMLESS FLEX, X, CPRG-112, RH, 1:1, PS 1
7	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
8	1	FP-0000645	BRACKET, SUPPORT, 1:1 RED., LPOD PS 1
12	1	HW/CAP-SS14	DUST COVER,RECEPTACLE,NON-SHORTING,SIZE 14,SS,W/CHAIN & RING
20	1	SW/WG-HAGS	SWITCH, WR112G, +24V, SEALED, STANDARD THREAD, COLD TEMP RATING
21	1	FP/WG0039	CNTRC, WAVEGUIDE FP - WAVEGUIDE, TERMINATION, 250W, CPR-112
22	1	RF-0000105	RF POWER SPLITTER/COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
23	6	GA/CPR112-R-F-C	GASKET, ROUND, CPR112, FULL THICKNESS, CONDUCTIVE
30	8	HW/1/4-20X1/2FH	1/4-20 x 1/2 LG FLAT HD PHILLIPS SCREW, 82°, UCUT, SS
33	10	HW-0000070	3/8-16 x 3/4 LG SCREW, HEX, FLNG, SERR, SS
34	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
35	2	HW/4-FLT	#4 FLAT WASHER, SS
36	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
37	2	HW/4-40X1.38PH	#4-40 x 1-3/8 LG PAN HD PHILLIPS SCREW, SS
40	44	HW/8-FLT	#8 FLAT WASHER, SS
41	42	HW/8-SPLIT	#8 SPLIT LOCK WASHER, SS
42	36	HW-0000325	#8-32 x 1/2 LG SCREW, HEX HD, SS
43	6	HW-0000326	#8-32 x 5/8 LG SCREW, HEX HD, SS
44	2	HW/8-32HEXNUT	#8-32 HEX NUT, SS
45	4	HW/6-FLT	#6 FLAT WASHER, SS
46	4	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
47	4	HW/6-32X5/16P.H	#6-32 x 5/16 LG PHILLIPS SCREW
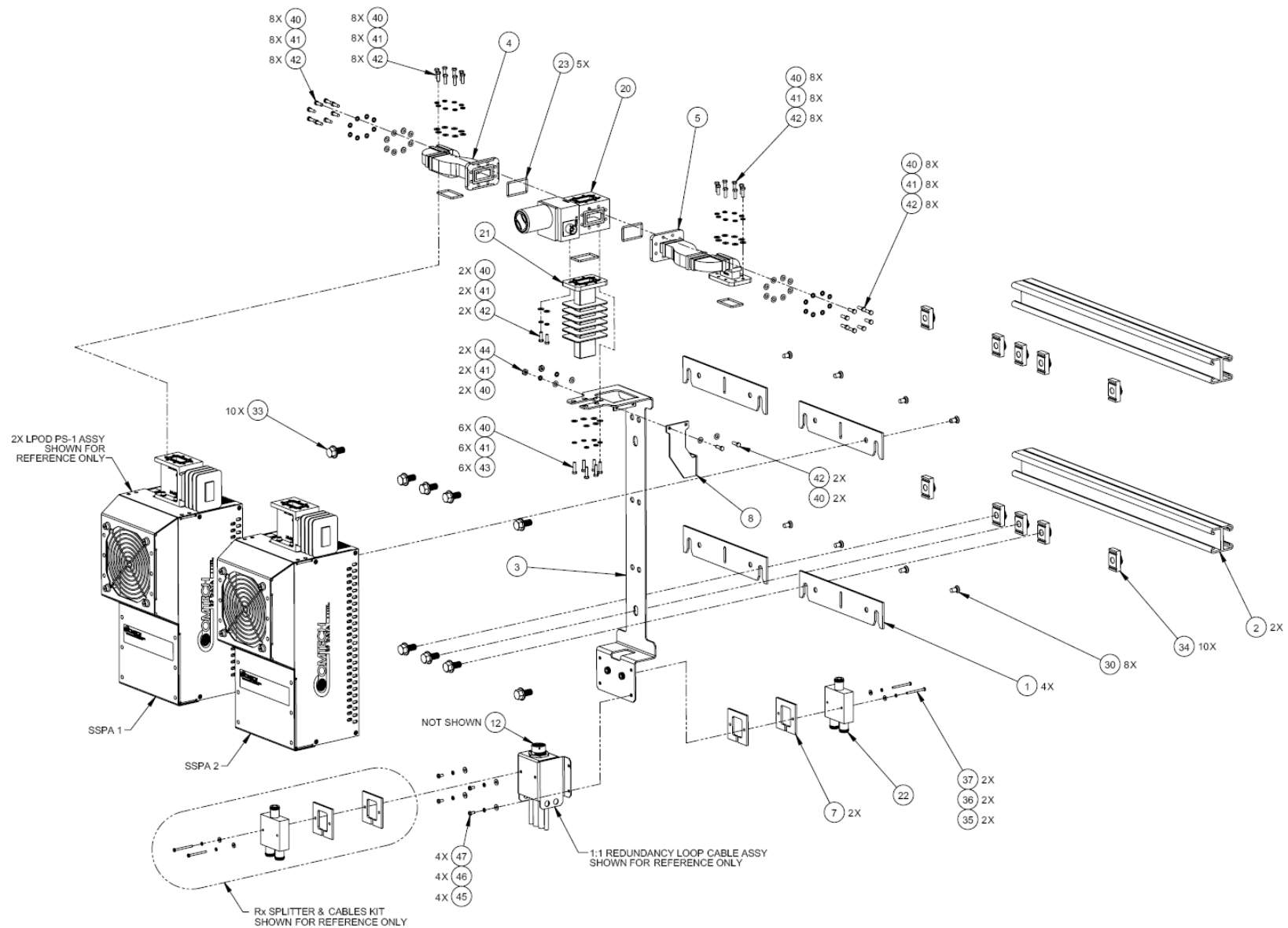
Figure A-18. KT-0000170 LPOD PS 1 X-Band 1:1 Redundancy Kit Example – Exploded Isometric View
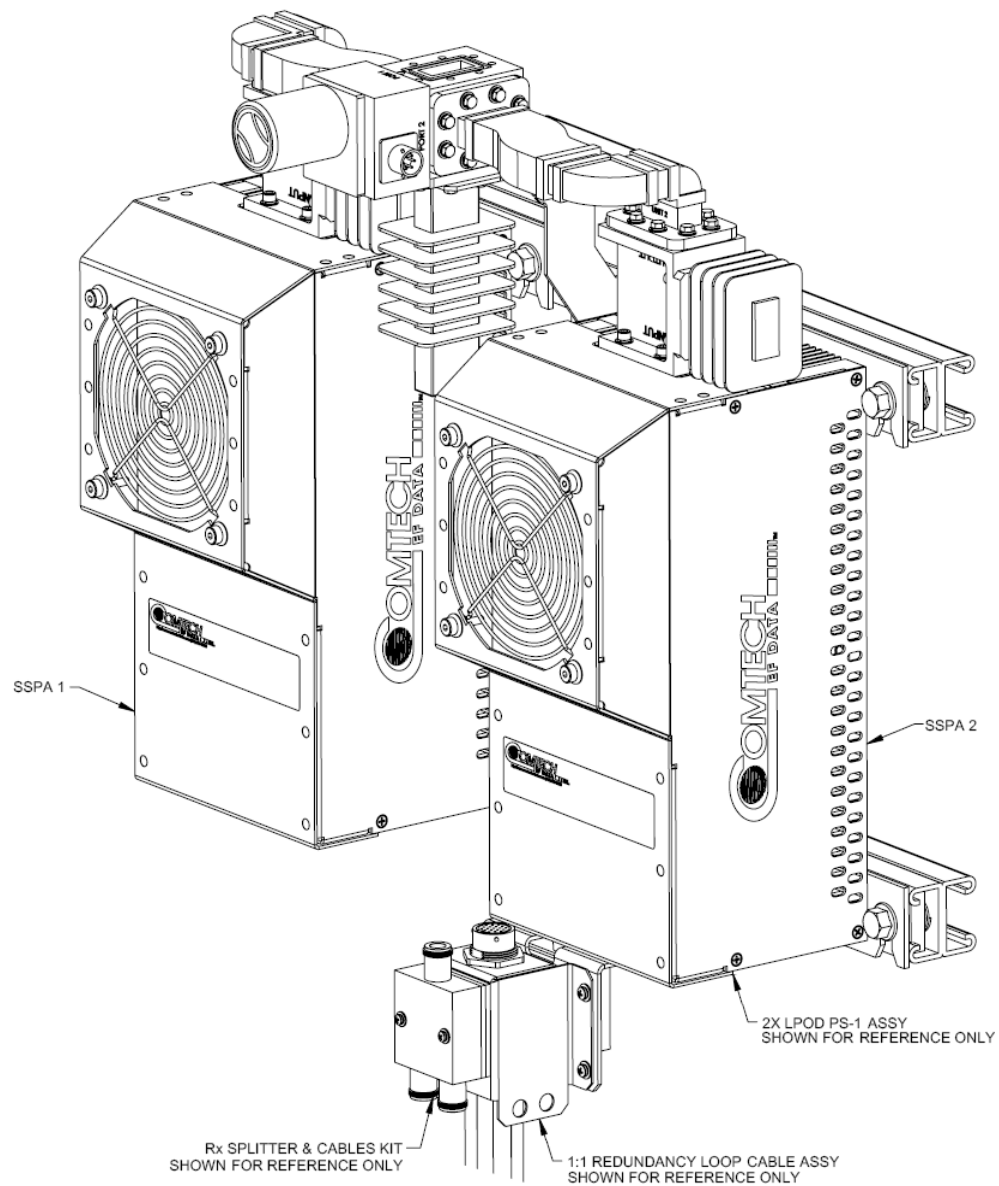
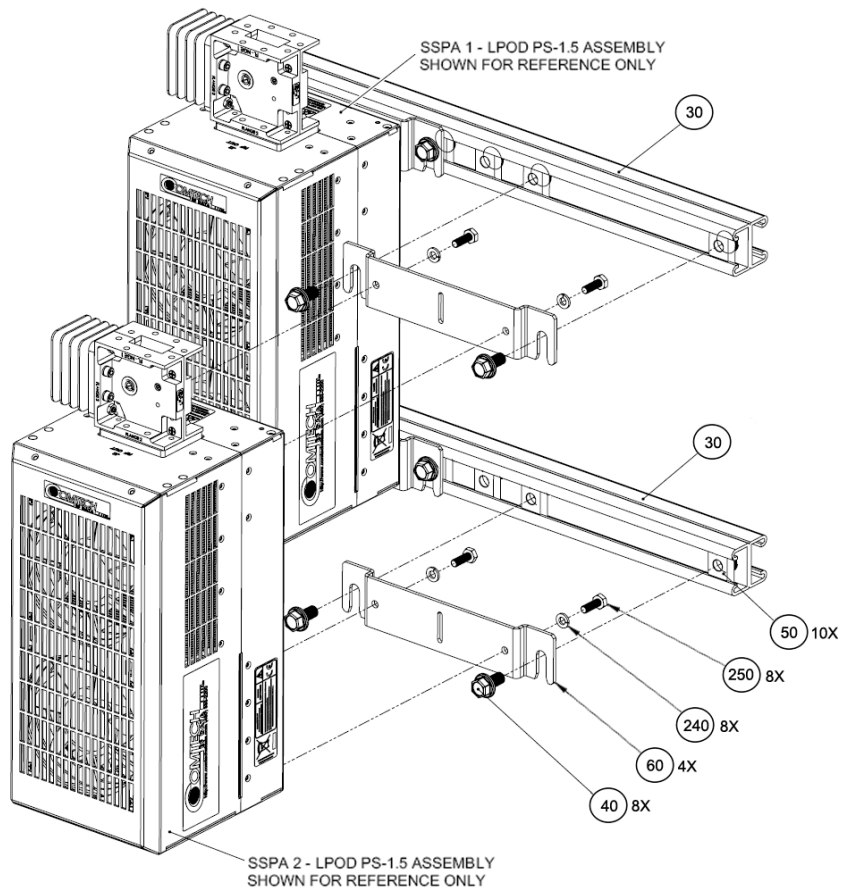**Figure A-19. KT-0000170 LPOD PS 1 X-Band 1:1 Redundancy Kit Example – Assembled Isometric View**

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A.5.3   LPOD PS 1.5 1:1 Redundancy Kit Examples

Table A-8. Parts List for KT-0020526 LPOD PS 1.5 C-Band DC Option 1:1 Redundancy Kit

ITEM	QTY	CEFD PART NUMBER	DESCRIPTION
KT-0020526 LPOD PS 1.5 C-BAND DC OPTION 1:1 REDUNDANCY KIT (AS PER FIGURES A-20 AND A-21)
30	2	FP-0000542	CHANNEL, DUAL, UNISTRUT
40	10	HW-0000070	SCREW, HEX, FLNG, 0.375-16 x 0.750, SS, SERR
50	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
60	4	FP-0020593	BRACKET, MOUNTING, DC LPOD
70	4	CA-0000348	CABLE ASSY, RF, 2 FT
80	1	HW/CAP-SS14	DUST COVER,RECEPTACLE,NON-SHORTING,SIZE 14,SS,W/CHAIN & RING
90	1	SW/WGS28V-137S	SWITCH, WAVEGUIDE, CPR137
100	1	FP/WG0034	MPS, BLANKET FP TERM
110	1	RF-0000105	RF POWER SPLITTER/COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
130	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
140	1	FP-0020594	SUPPORT BRACKET
150	1	FP-0020595	OUTPUT WAVEGUIDE, UNIT 1 TO PORT 4
160	1	FP-0020596	OUTPUT WAVEGUIDE UNIT 2 TO PORT 2
170	1	FP-0020592	BRACKET, MOUNTING, LPOD PS 1.5
180	5	GA/GSKTCP137HLF	GASKET, CP137, HALF THK
190	40	HW/10-FLT	#10 FLAT WASHER, SS
200	40	HW/10-SPLIT	#10 SPLIT WASHER, SS
210	40	HW/#10-32X5/8SHC	#10-32 x 5/8 LG SOCKET HD CAP SCREW, SS
220	4	HW/SEM632X5/16PH	#6-32 x 5/16 LG PHILLIPS HD SCREW, SS
230	1	PP-0020512	BALL DRIVER
240	8	HW/1/4-SPLIT	1/4" SPLIT WASHER., SS
250	8	HW/1/4-20X3/4BT	1/4-20 x 3/4 LG BOLT
260	12	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK
270	2	HW/SEM440X3/8PH	#4-40 x 3/8 LG PAN HD SCREW
280	5	HW/632X5/16FHMS	#6-32 x 5/16 FLAT HD MACHINE SCREW

STEP 1: SSPA INSTALLATION

STEP 2: SPLITTER/COMBINER/WAVEGUIDE BRACKET INSTALLATION
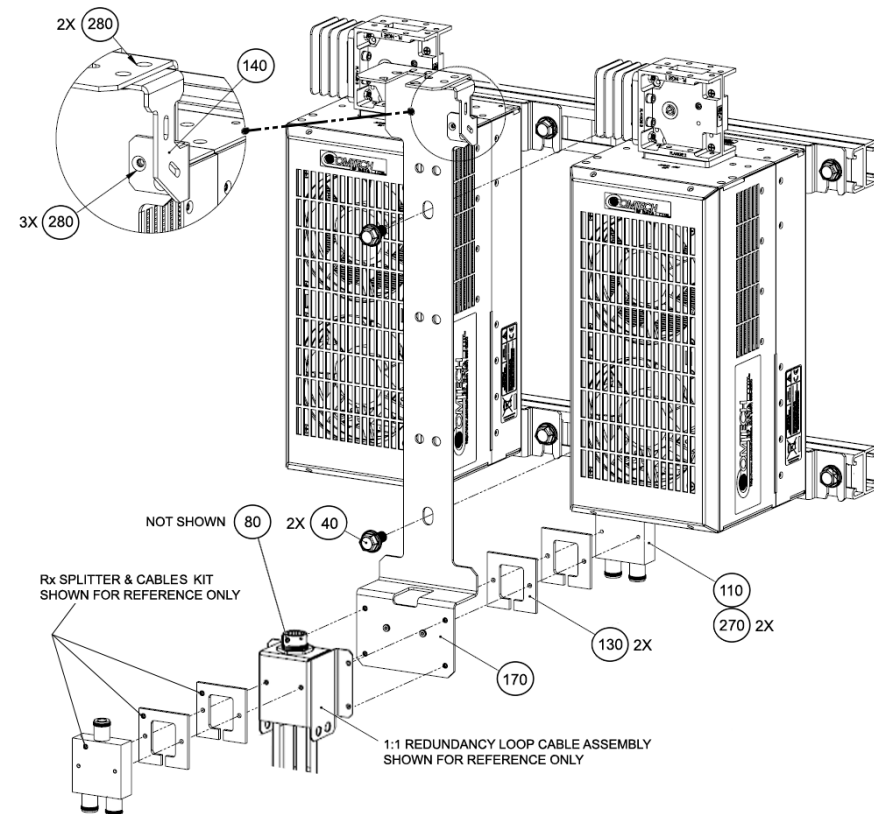

Figure A-20. KT-0020526 LPOD PS 1.5 C-Band DC Option 1:1 Redundancy Kit Example – Exploded Isometric Views, Steps 1 & 2
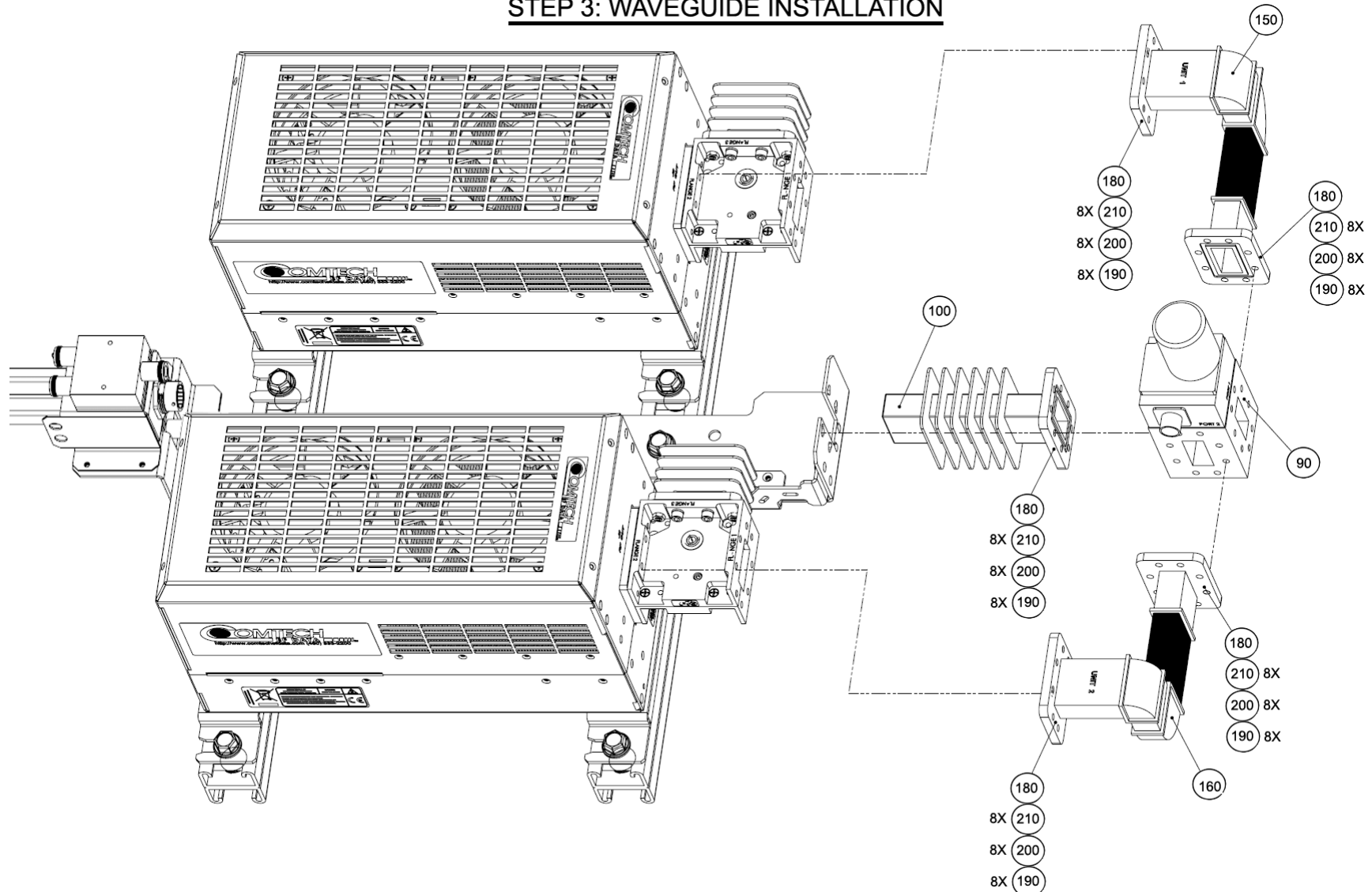
STEP 3: WAVEGUIDE INSTALLATION

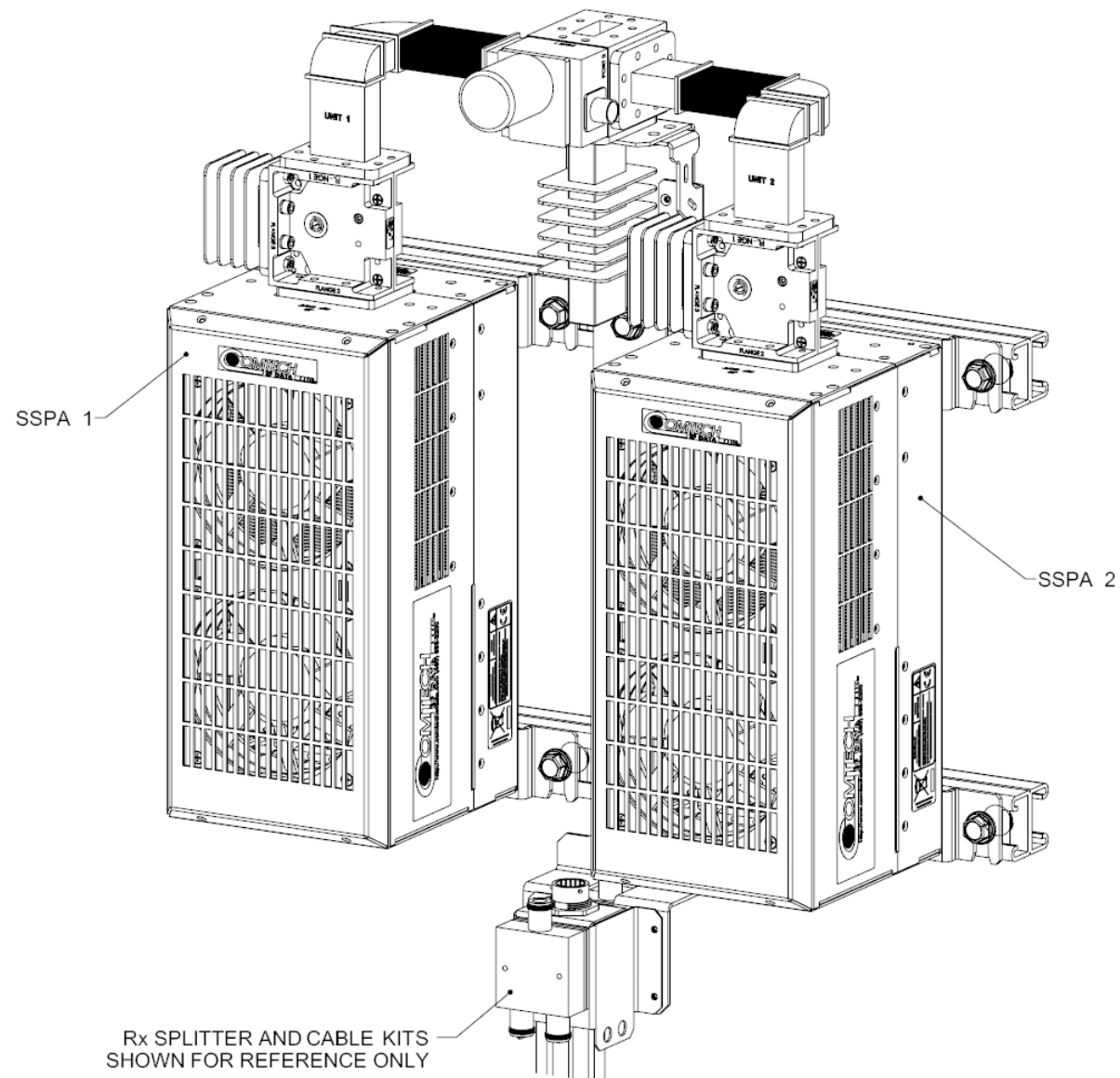**Figure A-21. KT-0020526 LPOD PS 1.5 C-Band DC Option 1:1 Redundancy Kit Example – Exploded Isometric View, Step 3**

Figure A-22. KT-0020526 LPOD PS 1.5 C-Band DC Option 1:1 Redundancy Kit Example – Assembled Isometric View

Table A-9. Parts List for KT-0000060 LPOD PS 1.5 Ku-Band 1:1 Redundancy Kit

ITEM	QTY	CEFD PART NUMBER	DESCRIPTION
			KT-0000060 LPOD PS 1.5 KU-BAND 1:1 REDUNDANCY KIT (AS PER FIGURE A-23)
0	2	CA-0000348	CABLE ASSY, RF, 2 FT
0	12	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK
1	4	FP-0000534	BRACKET, MOUNTING, LPOD PS 1
2	2	FP-0000542	CHANNEL, DUAL, UNISTRUT, 1:1 RDNT, LPOD PS 1
3	1	FP-0000537	BRACKET, UNIVERSAL, 1:1 RDNT, LPOD PS 1
4	1	FP-0000939	WAVEGUIDE, FORMED BENDS, Ku, WR-75, LH, 1:1, PS 1.5
5	1	FP-0000940	WAVEGUIDE, FORMED BENDS, Ku, WR-75, RH, 1:1, PS 1.5
7	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
8	1	FP-0000645	BRACKET, SUPPORT, 1:1 RED., LPOD PS 1
12	1	HW/CAP-SS14	DUST COVER,RECEPTACLE,NON-SHORTING,SIZE 14,SS,W/CHAIN & RING//(RE
20	1	SW/WGS28V-75SB	SWITCH, WAVEGUIDE, WR75, +28VDC, SEALED SIDE & BOTTOM MNT
21	1	RF/TERM-11923-5	RF TERMINATION, WR75G, 14-14.5GHz, 1.05:1 VSWR, 150W, FLAT BLACK, G
22	1	RF-0000105	RF POWER SPLITTER/COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
23	5	GA/GSKTWR75HALF	GASKET, WR75, HALF THK
30	8	HW/1/4-20X1/2FH	1/4-20 x 1/2 LG FLAT HD PHILLIPS SCREW,, 82°, UCUT, SS
33	10	HW-0000070	3/8-16 x 3/4 LG SCREW, HEX, FLNG,, SS, SERR
34	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
35	2	HW/4-FLT	#4 FLAT WASHER, SS
36	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
37	2	HW/4-40X1.38PH	#4-40 x 1/38 P.H. PHIILIPS SCREW, SS
39	24	HW/6-FLT	#6 FLAT WASHER, SS
40	24	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
41	4	HW/6-32X5/16P.H	#6-32 x 5/16 LG PHILLIPS SCREW
42	16	HW/6-32X1/2SHCS	#6-32 x 1/2 LG SOCKET HD CAP SCREW, SS
43	4	03P1111	#6-32 x 9/16 LG, SOCKET HD CAP SCREW, SS
44	2	HW/8-32X1/2SHCS	#8-32 x 1/2 LG SOCKET HD CAP SCREW, SS
45	4	HW/8-FLT	#8 FLAT WASHER, SS
46	2	HW/8-SPLIT	#8 SPLIT LOCK WASHER, SS
47	2	HW/8-32HEXNUT	#8-32 HEX NUT, SS

Figure A-23. KT-0000060 LPOD PS 1.5 Ku-Band 1:1 Redundancy Kit Example – Exploded Isometric View
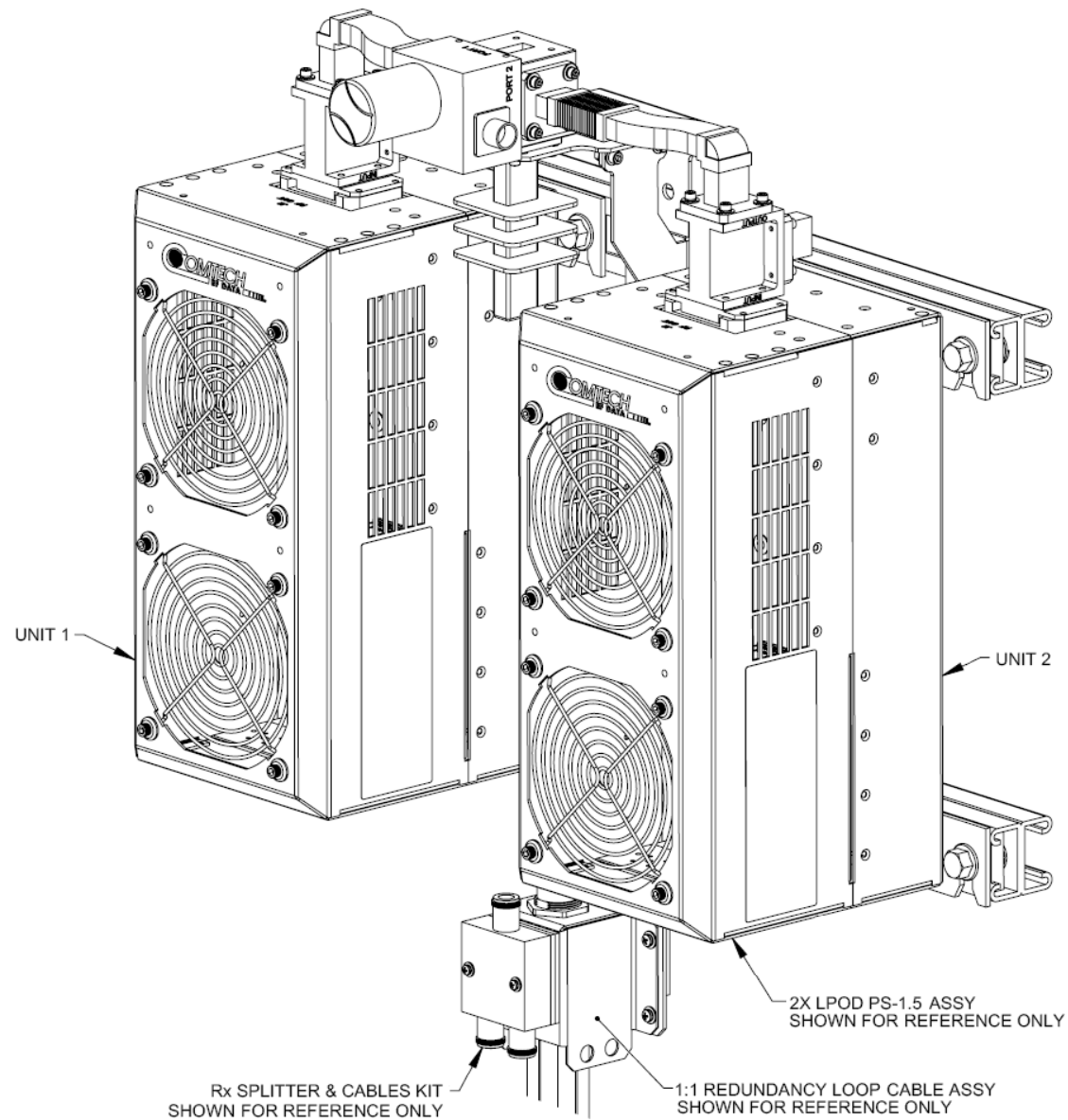
Figure A-24. KT-0000060 LPOD PS 1.5 Ku-Band 1:1 Redundancy Kit Example – Assembled Isometric View

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A.5.4   LPOD PS 2 1:1 Redundancy Kit Examples

1:1 REDUNDANT LPOD/SPOD MOUNTING
KIT SHOWN FOR REFERENCE

2X KT-0020827

Figure A-25. PS 2 C-Band 1:1 Redundancy Free Standing Kit Example Using KT-0020827 – Assembled Isometric View

Figure A-26. PS 2 C-Band 1:1 Redundancy Free Standing Kit Example Using KT-0020827 – Assembled Views

Table A-10. Parts List for KT-0000091 LPOD PS 2 C-Band 1:1 Redundancy Kit

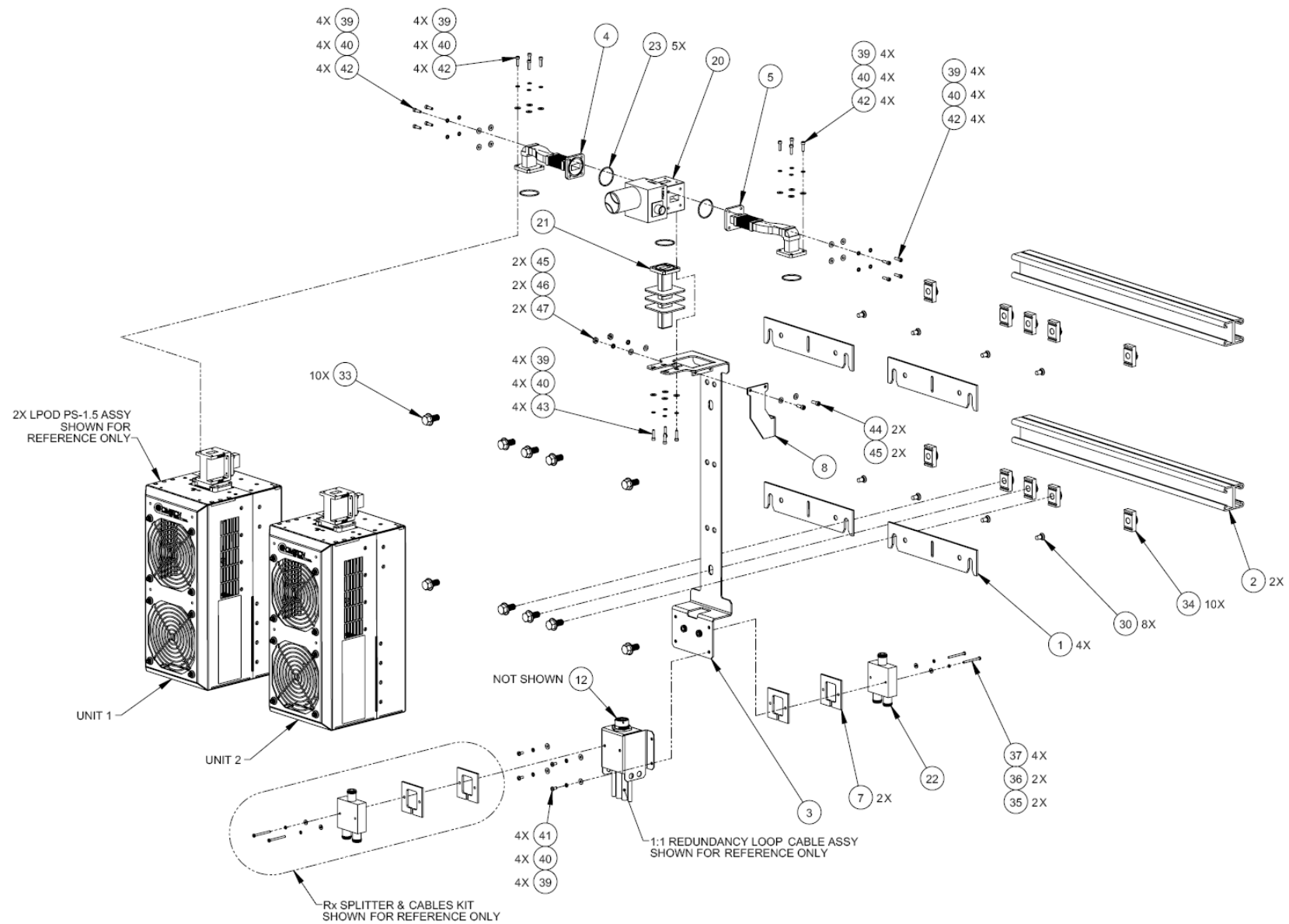| KT-0000091 LPOD PS 2 C-BAND 1:1 REDUNDANCY KIT (AS PER FIGURE A-27)			
ITEM	QTY	CEFD PART NO.	DESCRIPTION
1	1	FP-0000552	WAVEGUIDE, C-BAND, CPR-137 G, E TO H TO FLEX, LH, 1:1, PS 2
2	1	FP-0000553	WAVEGUIDE, C-BAND, CPR-137 G, E TO H TO FLEX, RH, 1:1, PS 2
3	4	FP-0000442	BRACK, MOUNTING, HPOD-LPOD PS 2
4	2	FP-0000543	CHANNEL, DUAL, UNISTRUT, 1:1 RDNT, LPOD PS 2
5	1	FP-0000626	BRACKET, RF SW, UNIVERSAL, 1:1 RED., LPOD PS 2
6	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
11	2	CA/RF0097	ASSY CABLE, ROHS CONNECTOR, CSAT-7075 OUTPUT RF, ROHS
12	1	HW/CAP-SS14	DUST COVER,RECEPTACLE,NON-SHORTING,SIZE 14,SS,W/CHAIN & RING
20	1	SW/WGS28V-137S	SWITCH, WAVEGUIDE, CPR137, +28V SEALED
21	1	FP/WG0034	PNQ, WAVEGUIDE TERMINATION, SMALL FINS
22	1	RF-0000105	RF POWER SPLITTER/COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
23	4	GA/CPR-137-R-H-C	GASKET, D SHAPE, CPR-137, HALF THICKNESS, CONDUCTIVE
24	2	GA/CPR137-R-F-C	GASKET, ROUND, CPR137, FULL THICKNESS, CONDUCTIVE
25	12	HW/TW14.5HDBLK	CABLE TIE, 14.5", HEAVY DUTY, BLACK
30	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
31	10	HW-0000070	3/8-16 x 3/4 LG SCREW, HEX, FLNG, SERR, SS
33	2	HW/4-40X1.38PH	#4-40 x 1-3/8 LG PAN HD PHIILIPS SCREW, SS
34	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
35	2	HW/4-FLT	#4 FLAT WASHER, SS
36	4	HW/6-32X5/16P.H	#6-32 x 5/16 PHILLIPS SCREW
37	4	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
38	4	HW/6-FLT	#6 FLAT WASHER, SS
39	26	HW/#10-32X1/2SH	#10-32 x 1/2 LG SOCKET HD CAP SCREW, SS
40	30	HW/#10-32X5/8SHC	#10-32 x 5/8 LG SOCKET HD CAP SCREW, SS
41	48	HW/10-SPLIT	#10 SPLIT LOCK WASHER, SS
42	48	HW/10-FLT	#10 FLAT WASHER, SS
43	8	HW/5/16-18X3/4B	5/16-18 x 3/4 LG HEX HD BOLT, SS
44	8	HW/5/16-SPLIT	5/16″ SPLIT LOCK WASHER
45	8	HW/5/16-FLT	5/16″ FLAT WASHER

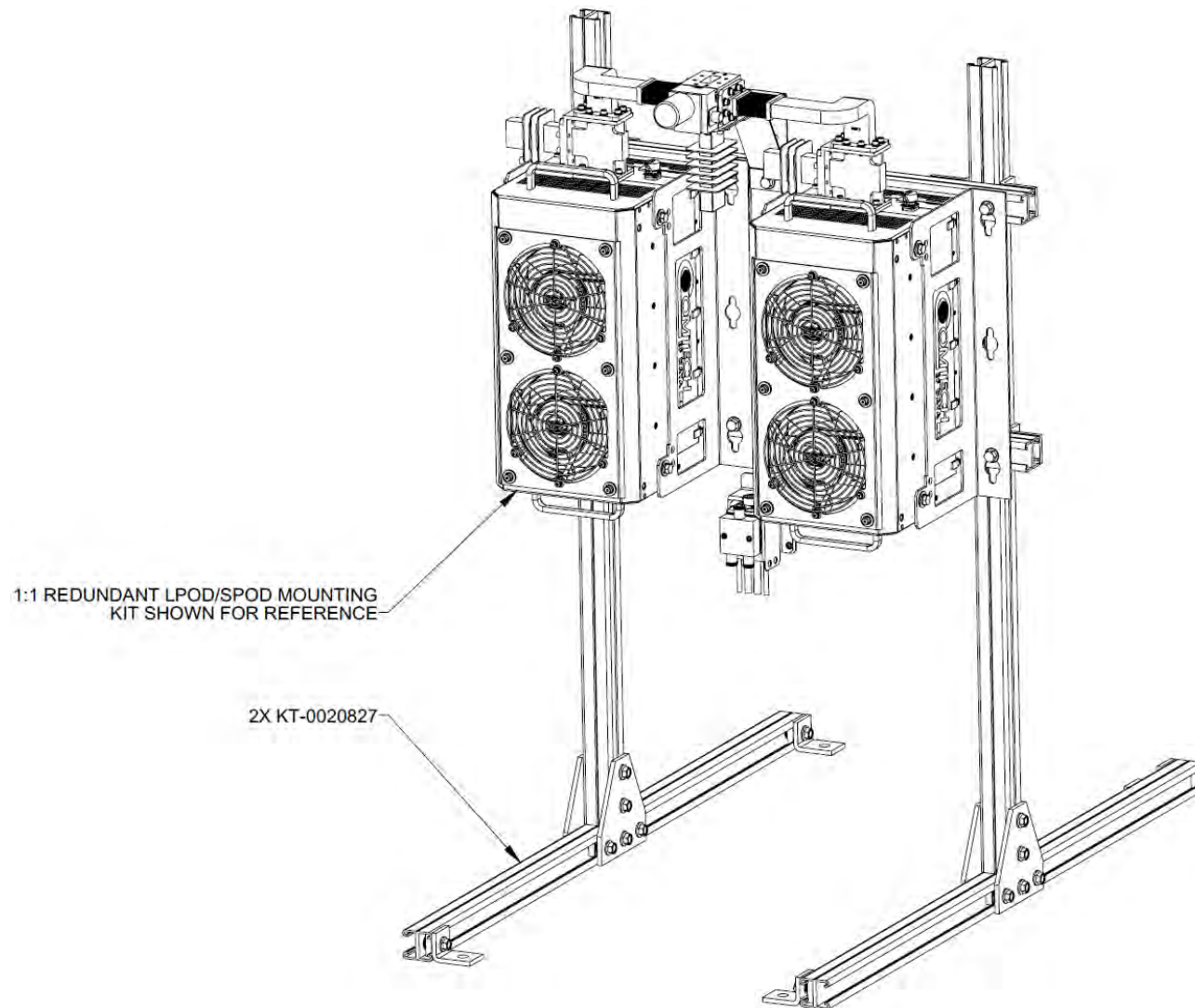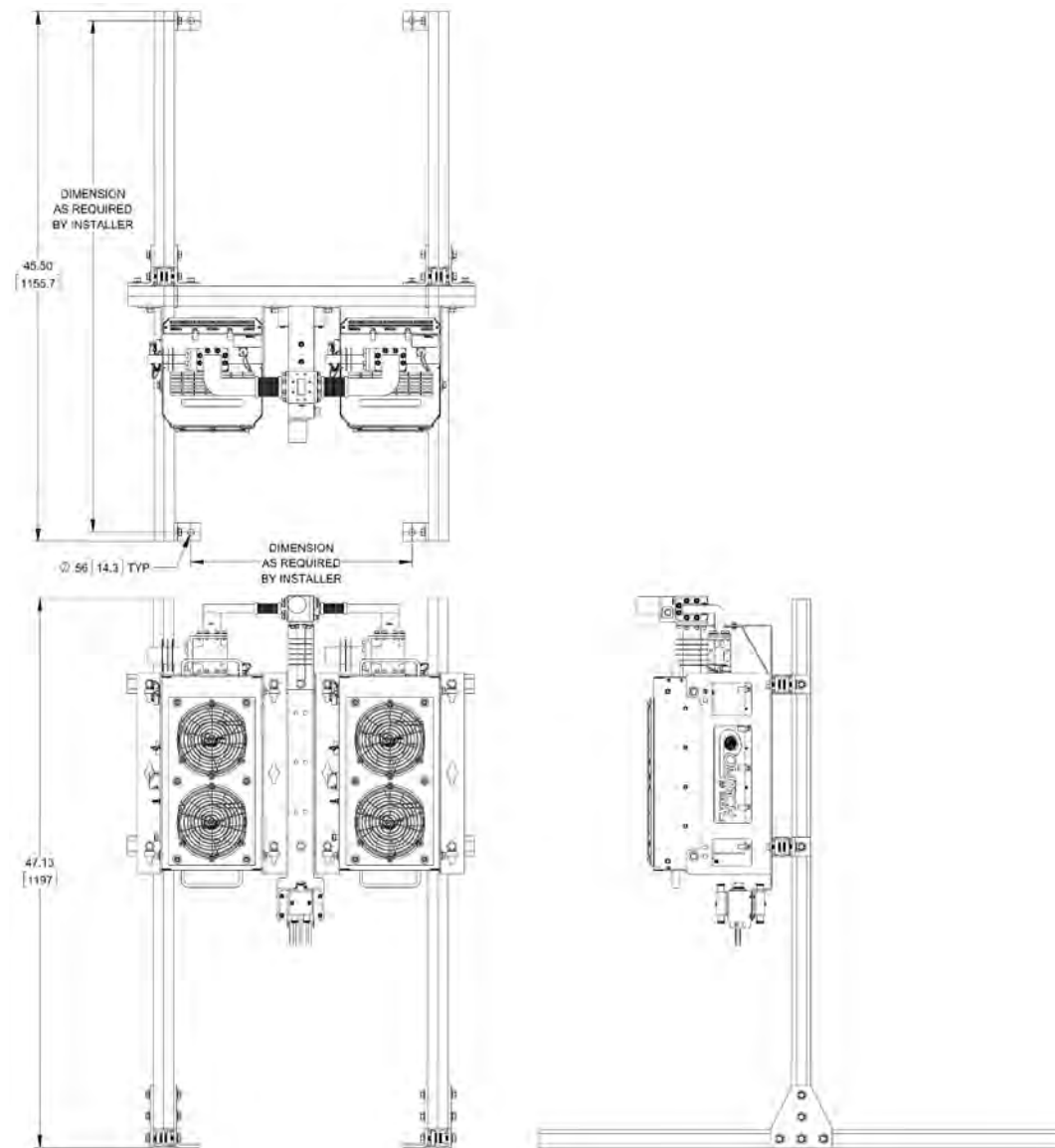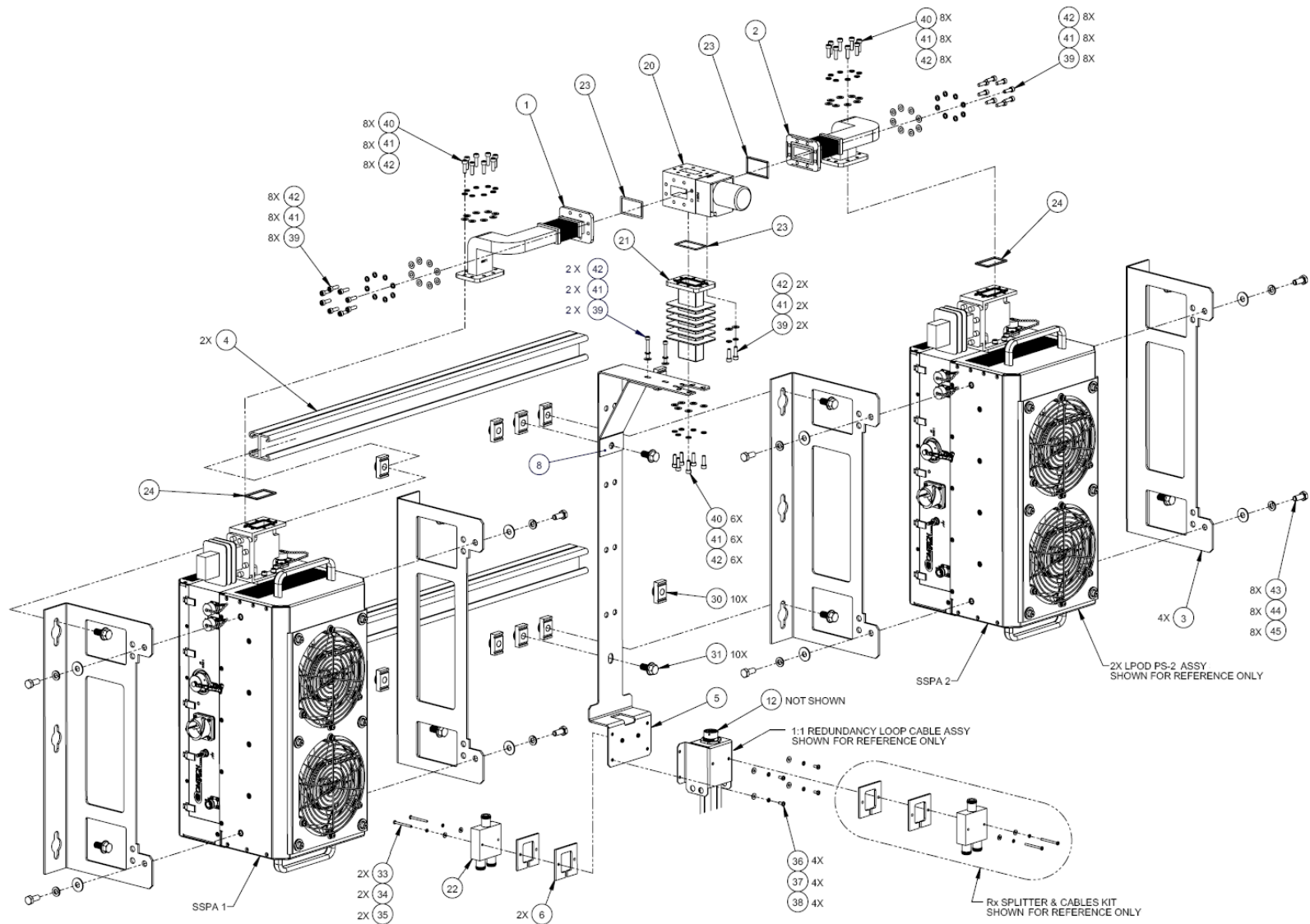**Figure A-27. KT-0000091 LPOD PS 2 C-Band 1:1 Redundancy Kit Example – Exploded Isometric View**
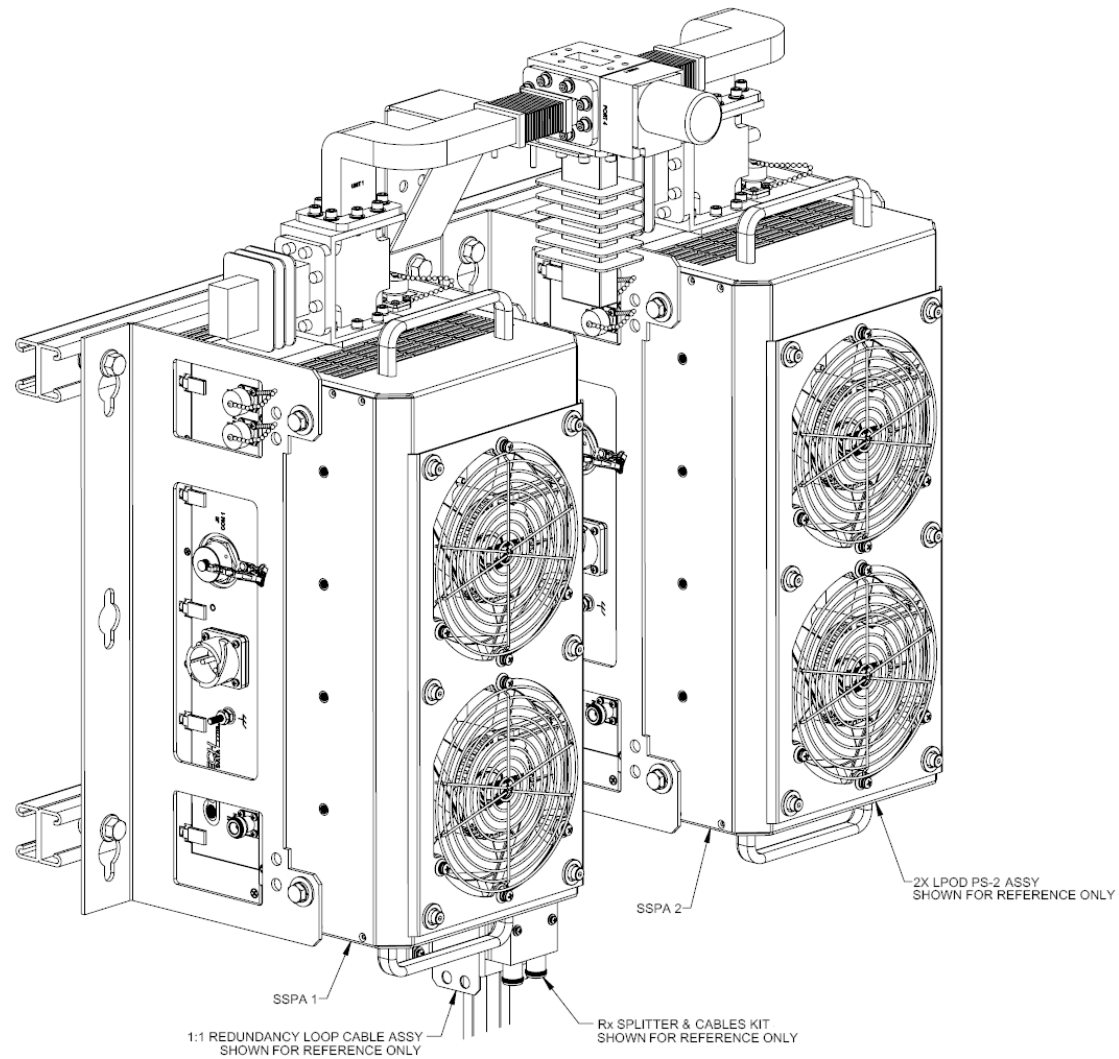
Figure A-28. KT-0000091 LPOD PS 2 C-Band 1:1 Redundancy Kit Example – Assembled Isometric View

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Table A-11. Parts List for KT-0000254 LPOD PS 2 Ku-Band 1:1 Redundancy Kit

| ITEM	QTY	CEFD PART NO.	DESCRIPTION
		KT-0000254 LPOD PS 2 KU-BAND 1:1 REDUNDANCY KIT (AS PER FIGURE A-29)	
1	1	FP-0001170	WAVEGUIDE, Ku-BAND, WR-75, LH, 1:1, LPOD PS 2
2	1	FP-0001171	WAVEGUIDE, Ku-BAND, WR-75, RH, 1:1. LPOD PS 2
3	4	FP-0000442	BRACK, MOUNTING, HPOD & LPOD PS 2
4	2	FP-0000543	CHANNEL, DUAL, UNISTRUT, 1:1 RDNT, LPOD PS 2
5	1	FP-0000626	BRACKET, RF SW, UNIVERSAL, 1:1 RED., LPOD PS 2
6	2	FP-0000580	SPACER PLATE, RF SPLITTER / COMBINER
8	1	FP-0000762	SUPPORT BRACKET, 1:1 REDUNDANT, LPOD PS 2
12	1	HW/CAP-SS14	DUST COVER,RECEPTACLE,NON-SHORTING, SIZE 14, SS,W/CHAIN & RING
20	1	SW/WGS28V-75SB	SWITCH, WAVEGUIDE, WR75, +28VDC, SEALED, SIDE & BOTTOM MOUNT
21	1	RF/TERM-11923-5	RF TERMINATION, WR75G, 14-14.5GHz, 1.05:1 VSWR, 150W, FLAT BLACK, G
22	1	RF-0000105	RF POWER SPLITTER / COMBINER, 2-WAY, 0 DEGREES, 1-2GHZ
23	5	GA/GSKTWR75HALF	GASKET, WR75, HALF THICK
30	10	HW/3/8SPRINGNUT	SPRINGNUT, 3/8-16, SHORT SPRING, SS (P3300)
31	10	HW-0000070	3/8-16 x 3/4 LG SCREW, HEX, SERR FLNG HD, SS
33	2	HW/4-40X1.38PH	SCREW #4-40 x 1-3/8 LG PHILLIPS HD, SS
34	2	HW/4-SPLIT	#4 SPLIT LOCK WASHER, SS
35	2	HW/4-FLT	#4 FLAT WASHER, SS
39	24	HW/6-FLT	#6 FLAT WASHER, SS
40	24	HW/6-SPLIT	#6 SPLIT LOCK WASHER, SS
41	4	HW/6-32X5/16P.H	#6-32 x 5/16 LG PHILLIPS SCREW
42	16	HW/6-32X1/2SHCS	#6-32 x 1/2 LG SOCKET HD CAP SCREW, SS
43	4	03P1111	#6-32 x 9/16 LG SCREW, SOCKET HD, SS
44	2	HW/#10-32X1/2SH	#10-32 x 1/2 LG SOCKET HD CAP SCREW, SS
45	2	HW/10-SPLIT	#10 SPLIT LOCK WASHER, SS
46	2	HW/10-FLT	#10 FLAT WASHER, SS
47	8	HW/5/16-18X3/4B	5/16-18 x 3/4 LG HEX HD BOLT, SS
48	8	HW/5/16-SPLIT	5/16" SPLIT LOCK WASHER
49	8	HW/5/16-FLT	5/16" FLAT WASHER
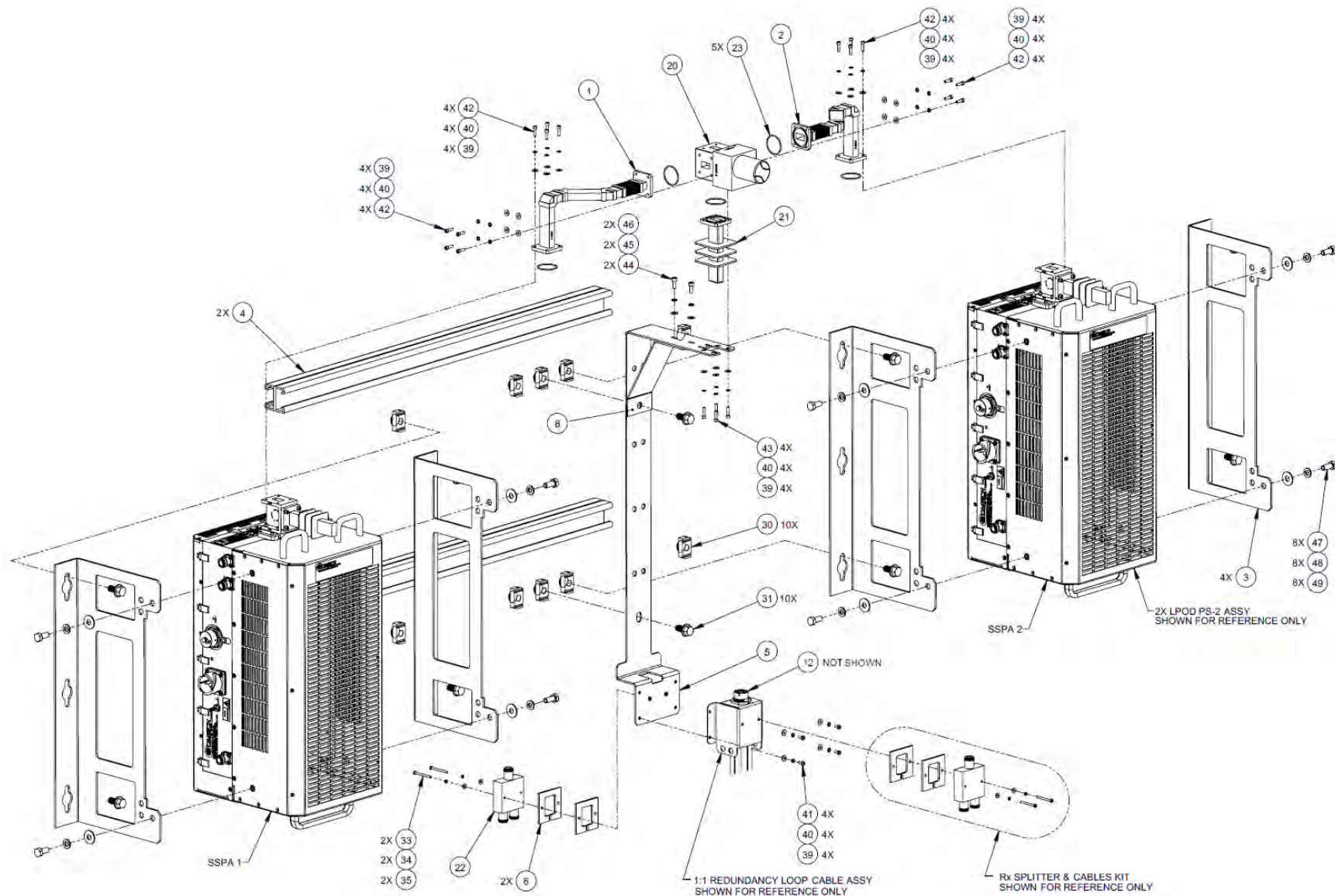
Figure A-29. KT-0000254 LPOD PS 2 Ku-Band 1:1 Redundancy Kit Example – Exploded Isometric View
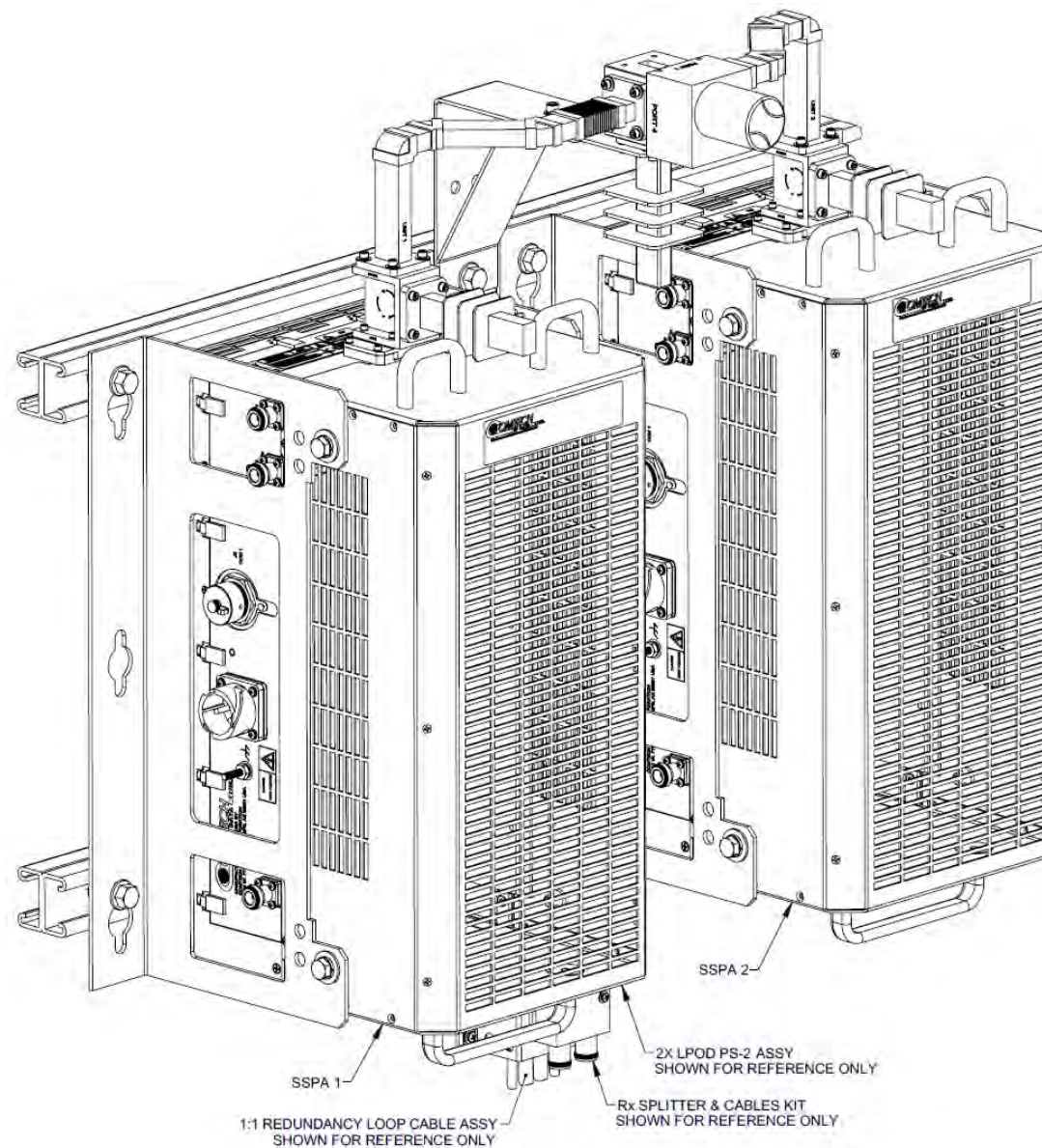
Figure A-30. KT-0000254 LPOD PS 2 Ku-Band 1:1 Redundancy Kit Example – Assembled Isometric View

Appendix B.   CABLE DRAWINGS

B.1   Overview

This appendix provides line details for the cables available for use with the LPOD in Standalone or 1:1 Redundancy applications. Each figure illustrates the cable's technical specifications – e.g., connector types used, cable labeling, wiring lists, etc.

The European EMC Directive (EN55022, EN50082-1) requires that you use properly shielded cables for DATA I/O. These cables must be double-shielded from end-to-end, ensuring a continuous ground shield.

The tables in this appendix cross-reference cable use in LPOD Standalone applications as well as the various 1:1 Redundancy application examples provided in Appendix A. 1:1 REDUNDANCY.

B.2 Control and Data Cables

App B FIG	CEFD CABLE P/N	DESCRIPTION	USED FOR:	REF App A FIG
B-1	CA-0020526	Serial Interface Cable (19-pin circular connector to RJ-11)	Connecting 1:1 Redundant Loop Cable 'J1' receptacle or Standalone LPOD 'J6 | PS ' receptacle to CLC-10 RJ-11 comms jack *(Cable and CLC-10 are furnished as part of optional CEFD KIT KT-0020518)*	A-1, A-3, A-12 through A-30
B-2	CA-0000352	Ethernet Interface Cable (19-pin circular connector to <2X> RJ-45)	Connecting 1:1 Redundant Loop Cable 'J1' receptacle or Standalone LPOD 'J6 | PS ' receptacle to LPOD*net* Ethernet jack *(Cable and LPODnet are furnished as part of optional CEFD KIT KT-0000203)*	A-2, A-3, A-12 through A-30
B-3	CA-0000318	100' COMMS Cable (19-pin circular connector to bare end)	Connecting 1:1 Redundant Loop Cable 'J1' receptacle or Standalone LPOD 'J6 | PS ' receptacle to user-specified M&C interface	A-3, A-12 through A-30
B-4	CA-0000543	250' COMMS Cable (19-pin circular connector to bare end)		A-3, A-12 through A-30
B-5	CA-0020655	Rx / Tx Redundant Loop Cable (19-pin circular receptacle to <2X> Type 'N' connectors, <2X> 19-pin circular connectors)	Interconnecting 1:1 Redundancy System LPOD units, Rx / Tx switches, and user M&C interface	A-3, A-12 through A-30
B-6	CA-0020657	Tx-only Redundant Loop Cable (19-pin circular receptacle to <1X> Type 'N' connector, <2X> 19-pin circular connectors)	Interconnecting 1:1 Redundancy System LPOD units, Tx switch, and user M&C interface	A-3, A-12 through A-30

B.2.1 Serial Interface Cable

The Comtech EF Data CLC-10 Serial M&C Accessory Kit (CEFD P/N KT-0020518) includes the CA-0020526 Serial Interface Cable. This kit is optionally available to provide serial-based monitor and control of 1:1 Redundancy or Standalone LPOD applications using the CLC-10 Comtech LPOD Controller (a preconfigured Two Technologies, Inc. TechTerm Handheld Terminal). The circular connector installs onto the Redundant Loop Cable '**J1**' connector in 1:1 LPOD Redundant applications, or the '**J6 | COM 1**' connector on a Standalone LPOD. The RJ-11 connector plugs directly into the CLC-10.
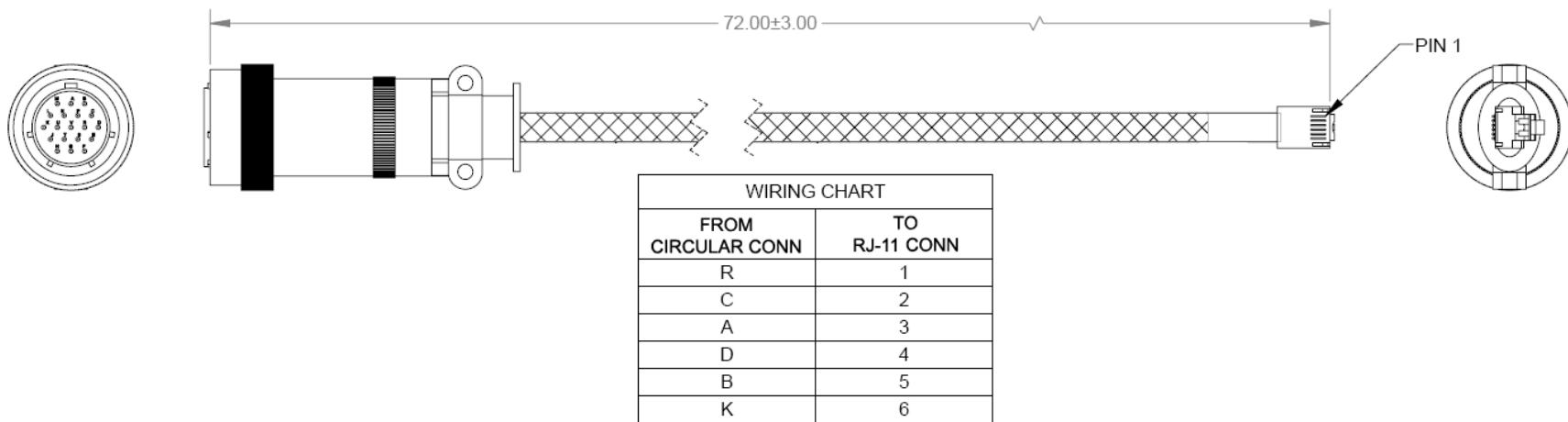

WIRING CHART	
FROM CIRCULAR CONN	TO RJ-11 CONN
R	1
C	2
A	3
D	4
B	5
K	6

Figure B-1. Serial Interface Cable (CEFD P/N CA-0020526, part of KT-0020518)

B.2.2   Ethernet Interface Cable

The Comtech EF Data Ethernet Utility Kit (CEFD P/N KT-0000203) includes the CA-0000352 Ethernet Interface Cable. This kit is optionally available to provide Ethernet-based M&C of 1:1 Redundancy or Standalone LPOD applications using a Samsung NB30 Plus Netbook (LPOD*net*). The '**P1**' circular connector installs onto the Redundant Loop Cable '**J1**' connector in 1:1 LPOD Redundant applications, or the '**J6 | COM 1**' connector on a Standalone LPOD. Use the '**J2**' and '**J3**' RJ-45 connectors to either connect directly to the LPOD*net*'s Ethernet network jack (for Standalone use) or via a user-provided Ethernet switch or hub (for 1:1 Redundancy use).

WIRE LIST

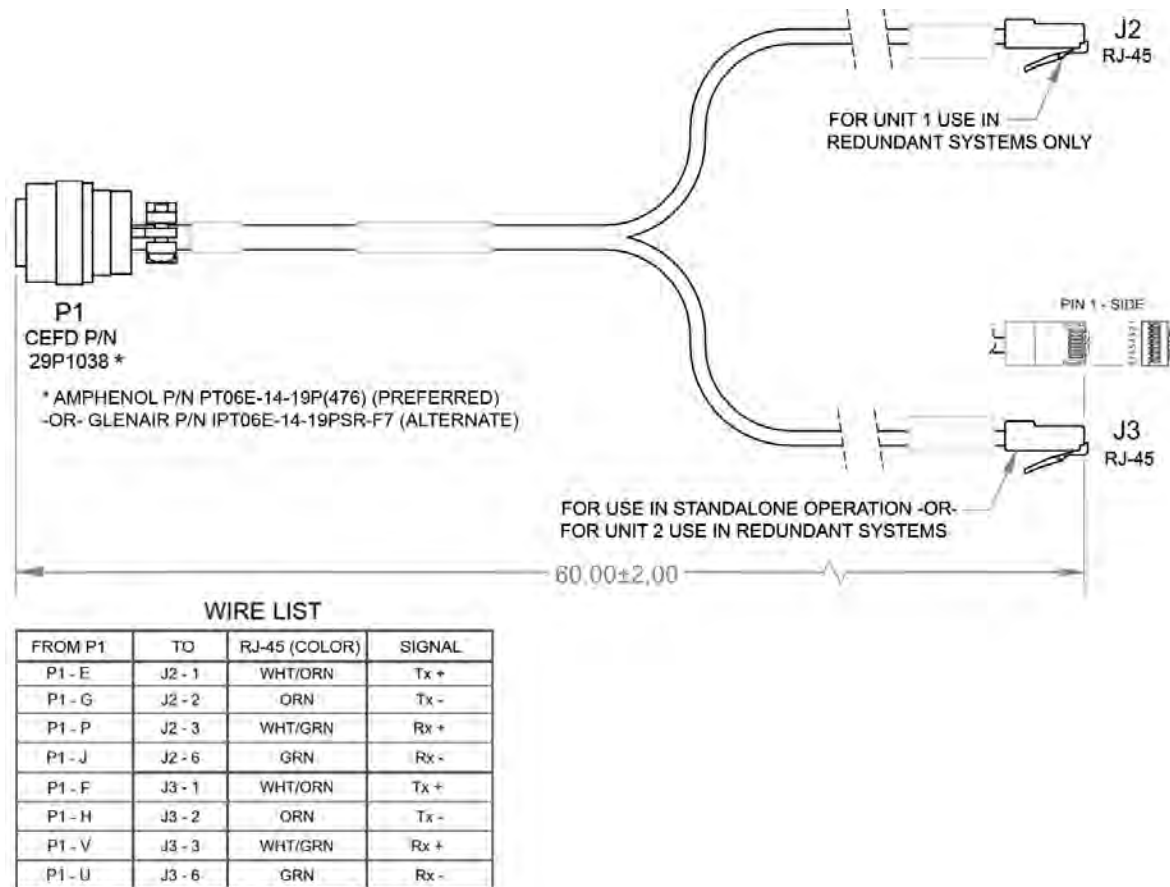| FROM P1	TO	RJ-45 (COLOR)	SIGNAL
P1 - E	J2 - 1	WHT/ORN	Tx +
P1 - G	J2 - 2	ORN	Tx -
P1 - P	J2 - 3	WHT/GRN	Rx +
P1 - J	J2 - 6	GRN	Rx -
P1 - F	J3 - 1	WHT/ORN	Tx +
P1 - H	J3 - 2	ORN	Tx -
P1 - V	J3 - 3	WHT/GRN	Rx +
P1 - U	J3 - 6	GRN	Rx -

Figure B-2. Ethernet Interface Cable (CEFD P/N CA-0000352, part of KT-0000203)

B.2.3   19-Pin COMMS Cable (100')

This cable connects between your designated data interface and the Redundant Loop Cable's **'J1'** connector in 1:1 Redundancy applications, or the **'J6 | COM 1'** port on a Standalone LPOD.
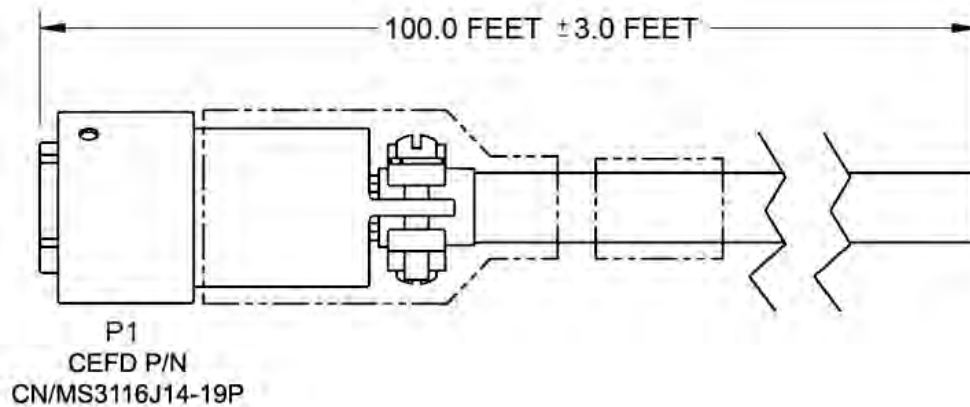
WIRE LIST

PIN	COLOR	SIGNAL
A	RED/BRN	RS485_+RX
B	BRN/RED	RS485_-RX
C	WHT/BLU	RS485_+TX
D	BLU/WHT	RS485_-TX
E	WHT/ORN	ENET_TX+_UNIT1
F	RED/ORN	ENET_TX+_UNIT2
G	ORN/WHT	ENET_TX-_UNIT1
H	ORN/RED	ENET_TX-_UNIT2
J	GRN/WHT	ENET_RX-_UNIT1
K	GRY/RED	GND
L	WHT/BRN	UNIT1_OK
M	BRN/WHT	UNIT2_OK
N	RED/BLU	TX_SW_POS1_LOW
P	WHT/GRN	ENET_RX+_UNIT1
R	RED/GRY	+24V
S	GRY/WHT	AUX_MUTE_LOW
T	BLU/RED	SWITCH_COM
U	GRN/RED	ENET_RX-_UNIT2
V	RED/GRN	ENET_RX+_UNIT2

P1
CEFD P/N
CN/MS3116J14-19P

100.0 FEET ±3.0 FEET

Figure B-3. COMMS Cable , 100' (CEFD P/N CA-0000318)

B.2.4   19-Pin COMMS Cable (250')

This cable connects between your designated data interface and the Redundant Loop Cable's **'J1'** connector in 1:1 Redundancy applications, or the **'J6 | COM 1'** port on a Standalone LPOD.
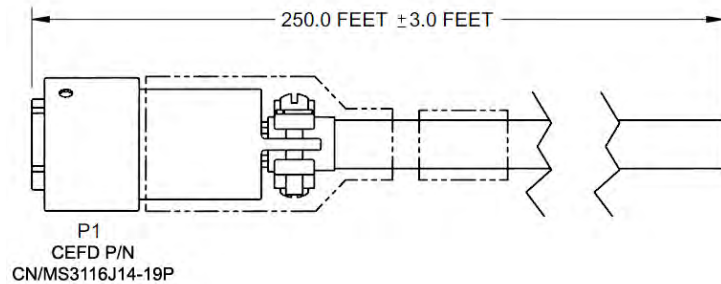
WIRE LIST

FROM	COLOR	LPOD / SPOD SINGLE UNIT	LPOD / SPOD REDUNDANT
P1-A	RED/BRN	RS485 +RX	RS485 +RX
P1-B	BRN/RED	RS485 -RX	RS485 -RX
P1-C	WHT/BLU	RS485 +TX	RS485 +TX
P1-D	BLU/WHT	RS485 -TX	RS485 -TX
P1-E	WHT/ORN	RS232 RD	10BASE-T TX+(B)
P1-F	RED/ORN	ETHERNET TX+	10BASE-T TX+(A)
P1-G	ORN/WHT	RS232 TD	10BASE-T TX-(B)
P1-H	ORN/RED	ETHERNET TX-	10BASE-T TX-(A)
P1-J	GRN/WHT	TX / RX SWITCH DRIVE 1 POS	10BASE-T TX-(B)
P1-K	GRY/RED	GROUND	GROUND
P1-L	WHT/BRN	SUM FAULT IN	CUST COMM UNIT A STATUS
P1-M	BRN/WHT	SUM FAULT OUT	CUST COMM UNIT B STATUS
P1-N	RED/BLU	TX SWITCH POS 1 IND	TX SWITCH POS 1 IND
P1-P	WHT/GRN	RX SWITCH POS 1 IND	10BASE-T TX+(B)
P1-R	RED/GRY	+24V	+24V
P1-S	GRY/WHT	SYSTEM MUTE CONTROL	SYSTEM MUTE
P1-T	BLU/RED	SWITCH COMMON	SWITCH COMMON
P1-U	GRN/RED	ETHERNET RX-	10BASE-T RX-(A)
P1-V	RED/GRN	ETHERNET RX+	10BASE-T RX+(A)

250.0 FEET ±3.0 FEET

P1
CEFD P/N
CN/MS3116J14-19P

Figure B-4. COMMS Cable, 250' (CEFD P/N CA-0000543)

B.2.5　Redundant Loop Cable – Rx / Tx

Use the CA-0020657 Redundant Loop Cable for interconnection of 1:1 Redundancy *Rx / Tx* applications. Use the **'J1'** connector to connect to your M&C interface. See the CONNECTOR LIST table in **Figure B-5** for routing the remaining connectors.
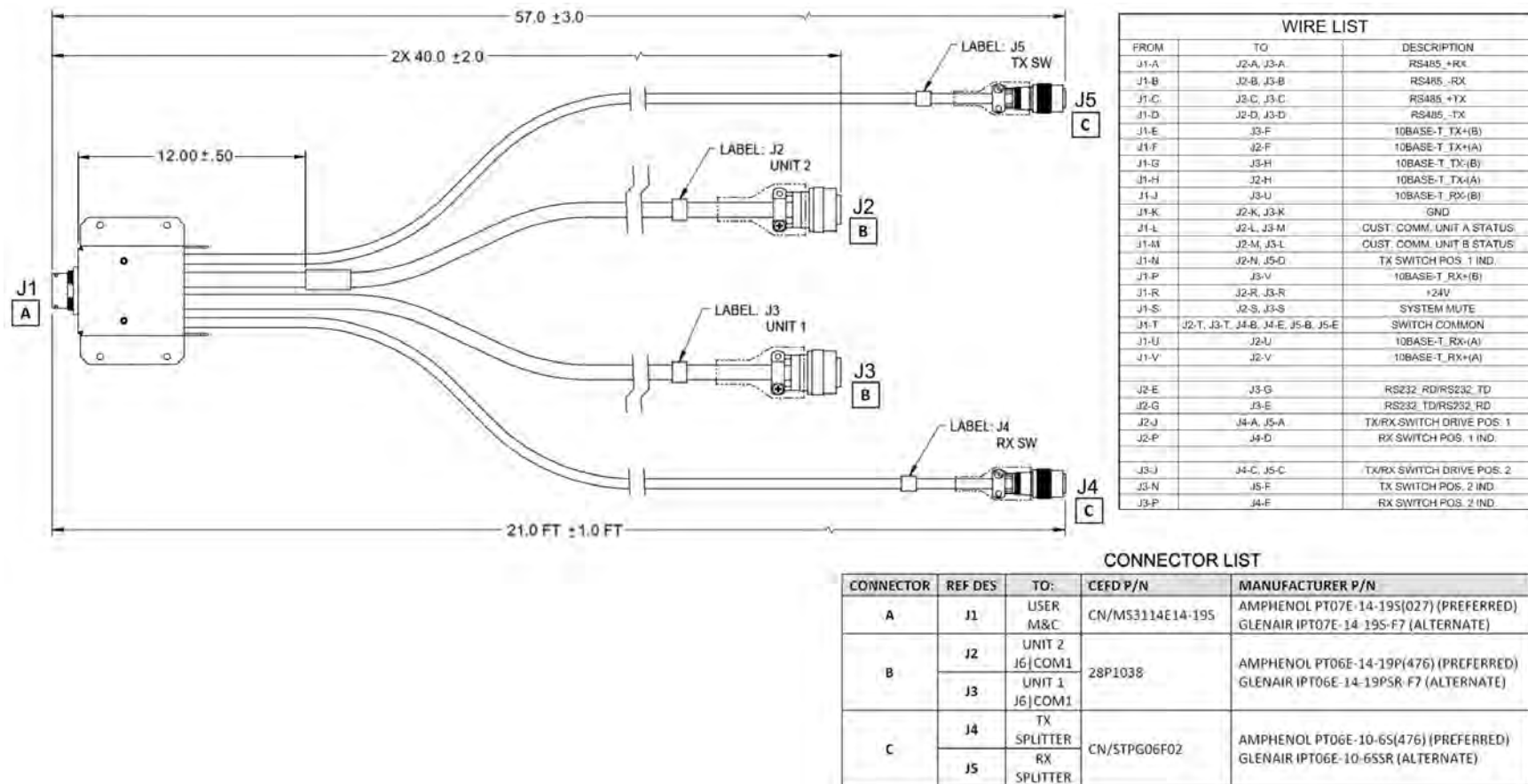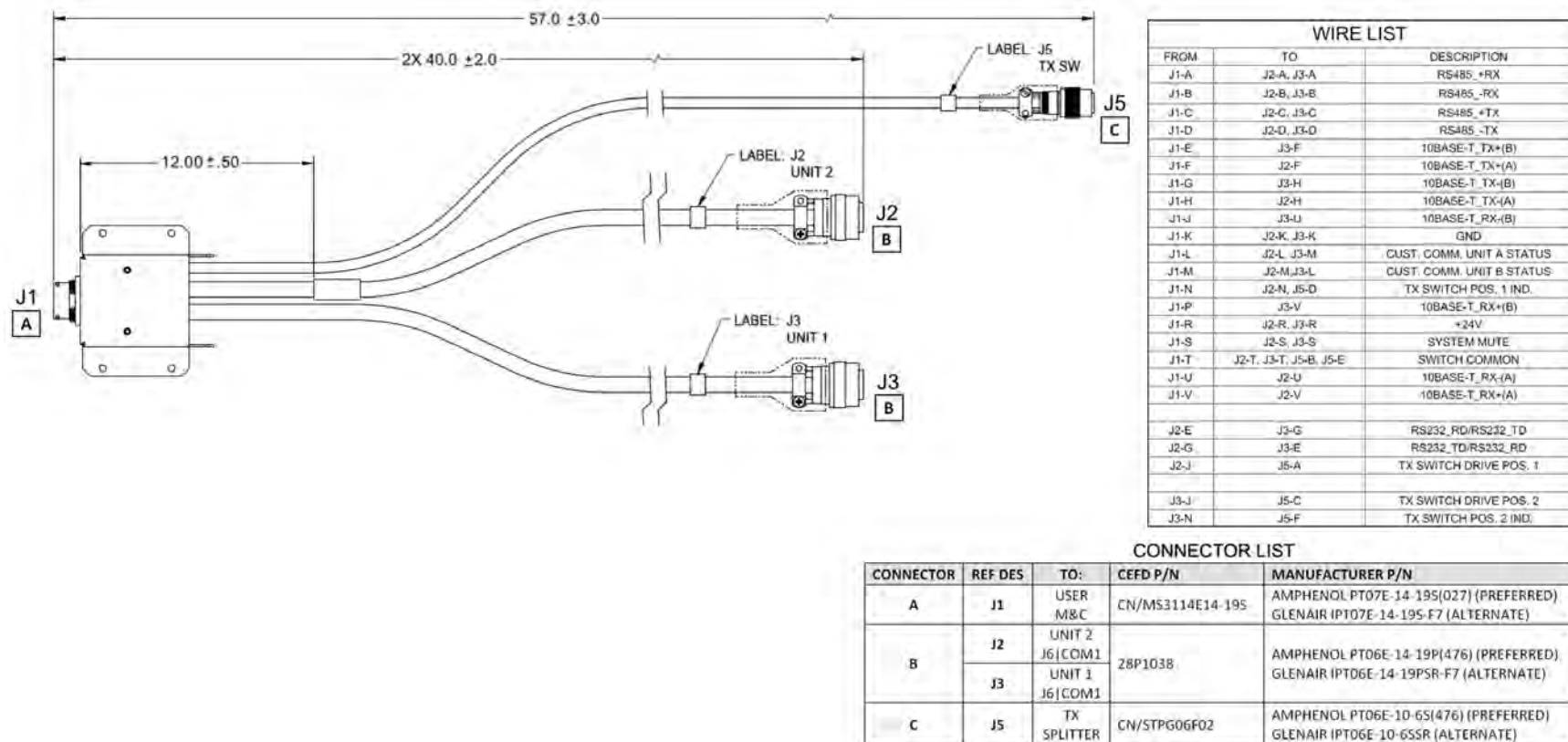

WIRE LIST

FROM	TO	DESCRIPTION
J1-A	J2-A, J3-A	RS485_+RX
J1-B	J2-B, J3-B	RS485_-RX
J1-C	J2-C, J3-C	RS485_+TX
J1-D	J2-D, J3-D	RS485_-TX
J1-E	J3-F	10BASE-T_TX+(B)
J1-F	J2-F	10BASE-T_TX+(A)
J1-G	J3-H	10BASE-T_TX-(B)
J1-H	J2-H	10BASE-T_TX-(A)
J1-J	J3-U	10BASE-T_RX-(B)
J1-K	J2-K, J3-K	GND
J1-L	J2-L, J3-M	CUST. COMM. UNIT A STATUS
J1-M	J2-M, J3-L	CUST. COMM. UNIT B STATUS
J1-N	J2-N, J5-D	TX SWITCH POS. 1 IND.
J1-P	J3-V	10BASE-T_RX+(B)
J1-R	J2-R, J3-R	+24V
J1-S	J2-S, J3-S	SYSTEM MUTE
J1-T	J2-T, J3-T, J4-B, J4-E, J5-B, J5-E	SWITCH COMMON
J1-U	J2-U	10BASE-T_RX-(A)
J1-V	J2-V	10BASE-T_RX+(A)
J2-E	J3-G	RS232_RD/RS232_TD
J2-G	J3-E	RS232_TD/RS232_RD
J2-J	J4-A, J5-A	TX/RX SWITCH DRIVE POS. 1
J2-P	J4-D	RX SWITCH POS. 1 IND.
J3-J	J4-C, J5-C	TX/RX SWITCH DRIVE POS. 2
J3-N	J5-F	TX SWITCH POS. 2 IND.
J3-P	J4-E	RX SWITCH POS. 2 IND.

CONNECTOR LIST

CONNECTOR	REF DES	TO:	CEFD P/N	MANUFACTURER P/N
A	J1	USER M&C	CN/MS3114E14-19S	AMPHENOL PT07E-14-19S(027) (PREFERRED) GLENAIR IPT07E-14-19S-F7 (ALTERNATE)
B	J2	UNIT 2 J6	COM1	28P1038	AMPHENOL PT06E-14-19P(476) (PREFERRED) GLENAIR IPT06E-14-19PSR-F7 (ALTERNATE)
B	J3	UNIT 1 J6	COM1		
C	J4	TX SPLITTER	CN/STPG06F02	AMPHENOL PT06E-10-6S(476) (PREFERRED) GLENAIR IPT06E-10-6SSR (ALTERNATE)
C	J5	RX SPLITTER		

Figure B-5. Redundant Loop Cable – Rx / Tx (CEFD P/N CA-0020657)

B.2.6   Redundant Loop Cable – Tx Only

Use the CA-0020655 Redundant Loop Cable for interconnection of 1:1 Redundancy *Tx-only* applications. Use the **'J1'** connector to connect to your M&C interface. See the CONNECTOR LIST table in **Figure B-6** for routing the remaining connectors.

WIRE LIST

FROM	TO	DESCRIPTION
J1-A	J2-A, J3-A	RS485_+RX
J1-B	J2-B, J3-B	RS485_-RX
J1-C	J2-C, J3-C	RS485_+TX
J1-D	J2-D, J3-D	RS485_-TX
J1-E	J3-F	10BASE-T_TX+(B)
J1-F	J2-F	10BASE-T_TX+(A)
J1-G	J3-H	10BASE-T_TX-(B)
J1-H	J2-H	10BASE-T_TX-(A)
J1-J	J3-U	10BASE-T_RX-(B)
J1-K	J2-K, J3-K	GND
J1-L	J2-L, J3-M	CUST. COMM. UNIT A STATUS
J1-M	J2-M, J3-L	CUST. COMM. UNIT B STATUS
J1-N	J2-N, J5-D	TX SWITCH POS. 1 IND.
J1-P	J3-V	10BASE-T_RX+(B)
J1-R	J2-R, J3-R	+24V
J1-S	J2-S, J3-S	SYSTEM MUTE
J1-T	J2-T, J3-T, J5-B, J5-E	SWITCH COMMON
J1-U	J2-U	10BASE-T_RX-(A)
J1-V	J2-V	10BASE-T_RX+(A)
J2-E	J3-G	RS232_RD/RS232_TD
J2-G	J3-E	RS232_TD/RS232_RD
J2-J	J5-A	TX SWITCH DRIVE POS. 1
J3-J	J5-C	TX SWITCH DRIVE POS. 2
J3-N	J5-F	TX SWITCH POS. 2 IND.

CONNECTOR LIST

CONNECTOR	REF DES	TO:	CEFD P/N	MANUFACTURER P/N
A	J1	USER M&C	CN/MS3114E14-19S	AMPHENOL PT07E-14-19S(027) (PREFERRED) GLENAIR IPT07E-14-19S-F7 (ALTERNATE)
B	J2	UNIT 2 J6|COM1	28P1038	AMPHENOL PT06E-14-19P(476) (PREFERRED) GLENAIR IPT06E-14-19PSR-F7 (ALTERNATE)
	J3	UNIT 1 J6|COM1		
C	J5	TX SPLITTER	CN/STPG06F02	AMPHENOL PT06E-10-6S(476) (PREFERRED) GLENAIR IPT06E-10-6SSR (ALTERNATE)

Figure B-6. Redundant Loop Cable –Tx Only (CEFD P/N CA-0020655)

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B.3   RF Cables

App B FIG	CEFD CABLE P/N	DESCRIPTION	USED FOR:	REF App A FIG
B-7	CA/3722-X	Type 'N' to Type 'N' 1/4" Heliax Coaxial Cable (lengths vary)	LPOD Rx or Tx connections in 1:1 Redundancy or Standalone LPOD applications	A-3

B.3.1   RF Cable (Type 'N')

Use this Type 'N' cable for the Rx or Tx connections in LPOD Standalone or 1:1 Redundancy applications:

- For LPOD PS-1 C-Band and X-Band applications – For Standalone use, the cable connects the unit's '**J2 | RF OUT'** port directly to the your Rx signal destination. For 1:1 Redundancy applications, use the cable to connect each LPOD's '**J2 | RF OUT'** port to the Tx Waveguide switch.

- For all LPOD applications – For Standalone use, the cable connects directly from these LPOD interfaces to your Rx signal destination or Tx signal source. For 1:1 Redundancy applications, use the cable to connect the '**J1 | LBAND IN / Tx IN'** or '**J10 | MODEM Rx'** ports in 1:1 Redundancy applications to the system's respective signal splitters.

PART NO.	DIM A
CA/3722	144.00 ± 4.00
CA/3722-1	48.00 ± 1.50
CA/3722-2	60.00 ± 2.00
CA/3722-3	90.00 ± 2.00
CA/3722-4	264.00 ± 4.00
CA/3722-5	288.00 ± 4.00
CA/3722-6	72.00 ± 2.00
CA/3722-7	240.00 ± 4.00
CA/3722-8	120.00 ± 4.00
CA/3722-9	180.00 ± 4.00
CA/3722-10	192.00 ± 12.00
CA/3722-11	108.00 ± 4.00

NOTE: CABLE MUST MEET VSWR 10.96-12.75 ≤ 1.40:1
WITH INSERTION LOSS AS FOLLOWS:

FREQUENCY MHz	ATTENUATION db/100ft	ATTENUATION db/100 M	AVERAGE POWER kW
10000	21.8	71.5	0.054
12000	24.3	79.7	0.049
14000	26.7	86.3	0.044
16000	29.0	95.2	0.040

DIM A

LABEL BOTH ENDS
HEAT SHRINK BOTH ENDS
CONNECTOR: TYPE "N" MALE
ANDREW P/N FIPNM-HR OR EQUIVALENT
CABLE: 1/4" SUPER FLEXIBLE HELIAX
ANDREW P/N FSJ1P-50A-4B OR EQUIVALENT
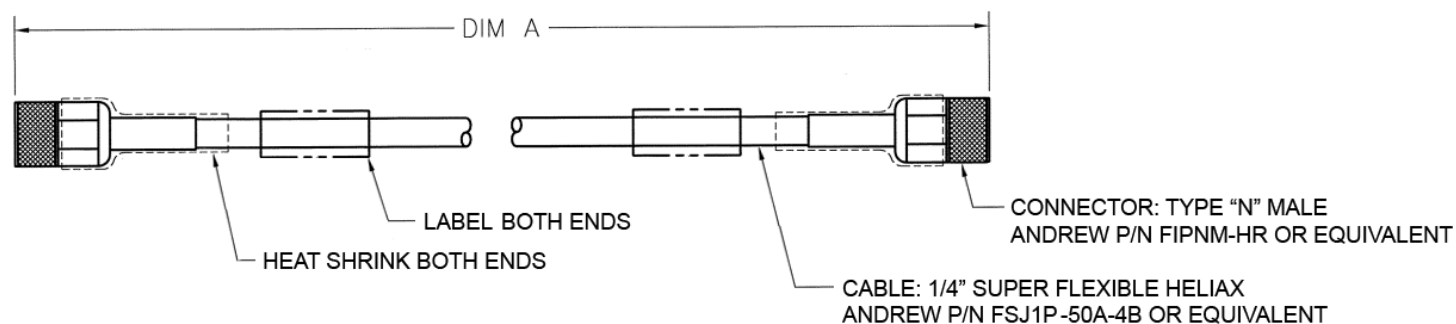
Figure B-7. 1/4" Heliax Coaxial Cable (CEFD P/N CA/3722-X)

Notes:

Appendix C. MAINTENANCE

C.1 Overview

| LPOD PS 1 | LPOD PS-1 5 | LPOD PS 2 |

Figure C-1. Comtech EF Data LPOD Outdoor Amplifiers / BUCs

The fans used by Comtech EF Data's LPOD family of Outdoor Amplifiers / Block Up Converters (BUCs) (**Figure C-1**) are designed for long life, even in harsh environments. Still, they are mechanical devices, subject to wear, and may need replacement after several years.

In most environments, Comtech EF Data recommends clearing the heat sinks of dust and debris approximately once per year to ensure optimal fan life. You can use the temperature trending data, available from the LPOD Web Server Interface '**Status | Graphs**' page (**Figure C-2**) as a guide to determine if more or less frequent preventative maintenance is required.

Sect. 4.5.5.4.5 Status | Graphs (Chapter 5. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT)

This appendix outlines the procedures for uninstalling the LPOD PD-1, PS-1.5, or PS-2 fan shroud, inspecting and cleaning the heat sinks, and then re-installing the fan shroud.
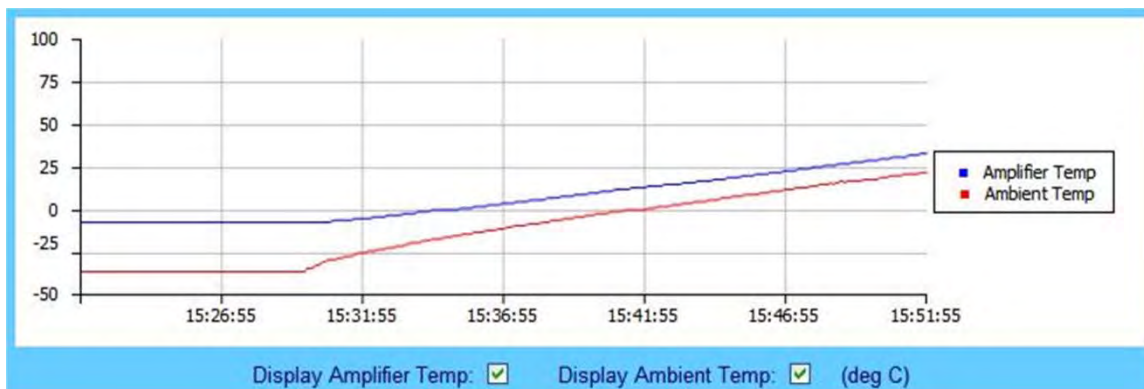
Figure C-2. LPOD Web Server Interface 'Status |Graphs' Page – Temperature Graph

C.2 Clean the LPOD PS-1 Heat Sinks

To clean the LPOD PS-1 Heat Sinks, do these steps:

Step	Task
1	Disconnect power from the LPOD.
2	Remove the eight screws – four on either side of the fan shroud – see **Figure C-3**. ⓘ **Make sure that you use an appropriate screwdriver, such as the one provided with the LPOD, to avoid damaging the screws.**
3	Lift the fan shroud assembly far enough off the chassis to expose the heat sinks and access the fan's power supply connection – see **Figure C-4**.
4	Disconnect the fan power supply. First, depress the connector's locking mechanism, and then pull apart the mated components – see **Figure C-5**.
5	Visually inspect the the exposed LPOD heat sinks, located on the top and either side of the chassis, for any accumulated debris or blockage that may be obstructing airflow. Use compressed air to clear and clean the heat sinks as needed – see **Figure C-6**. ⓘ **Make sure that you blow** <u>between</u> **the heat sink fins to remove any foreign object accumulation.**
6	Reconnect the fan power supply by pressing the male and female connectors together until the locking mechanism snaps and locks – see **Figure C-7**.
7	Re-install the fan shroud onto the chassis – make sure that you keep the fan power supply cable clear of the fan and heat sink surfaces. Then, re-install the eight screws as described in **Step 2**. ⓘ **Torque the screws to 11 ±2 inch lbs.**
8	Reconnect the power source to the LPOD.
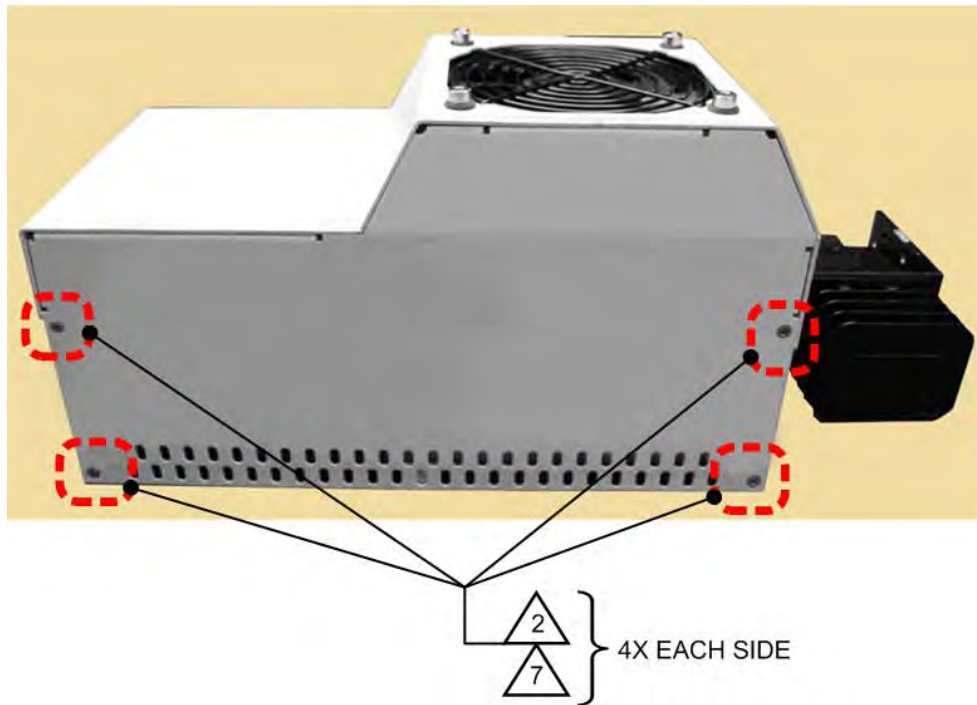
Figure C-3. LPOD PS-1 Shroud Screw Locations
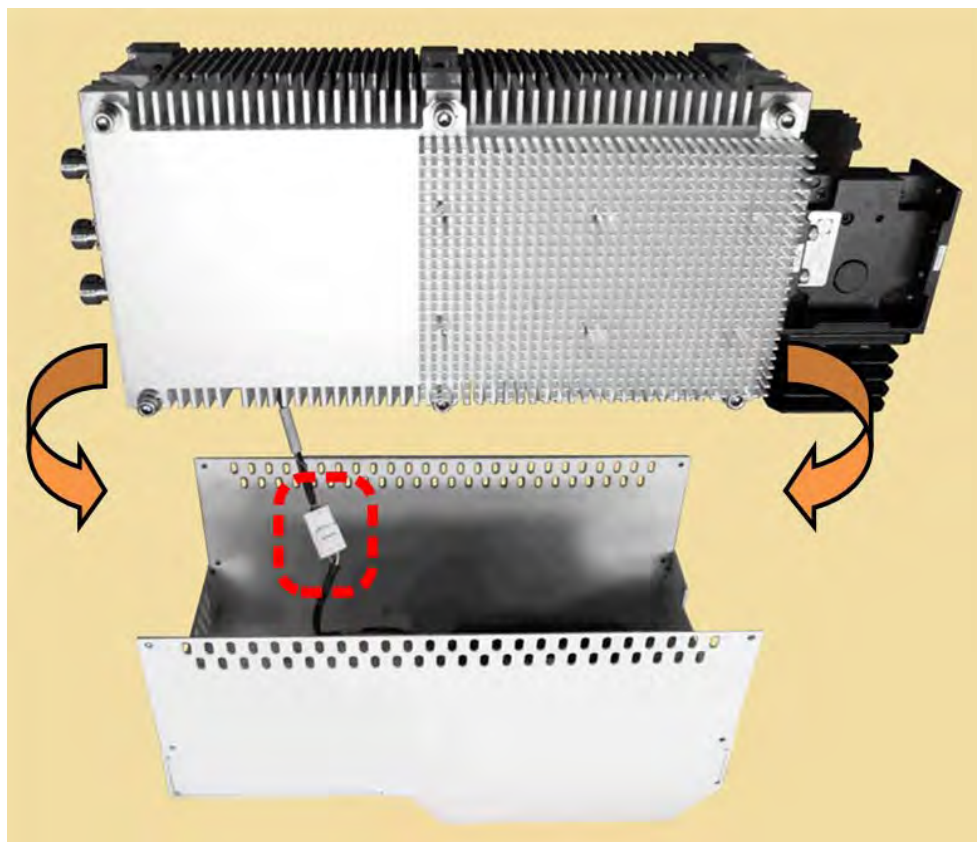
Figure C-4. Remove the Fan Shroud
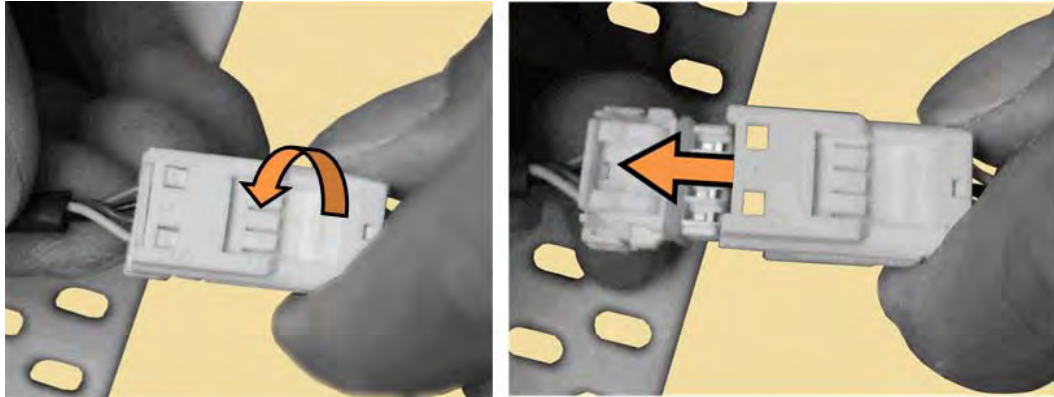
Figure C-5. Disconnect the Fan Power Supply
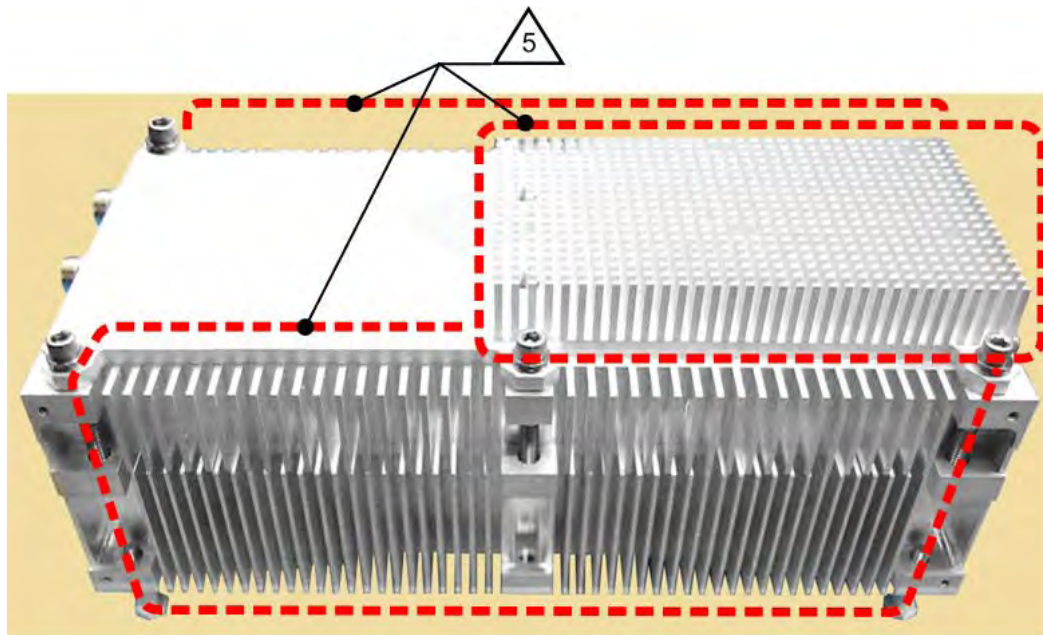
Figure C-6. LPOD PS-1 Heat Sink Locations
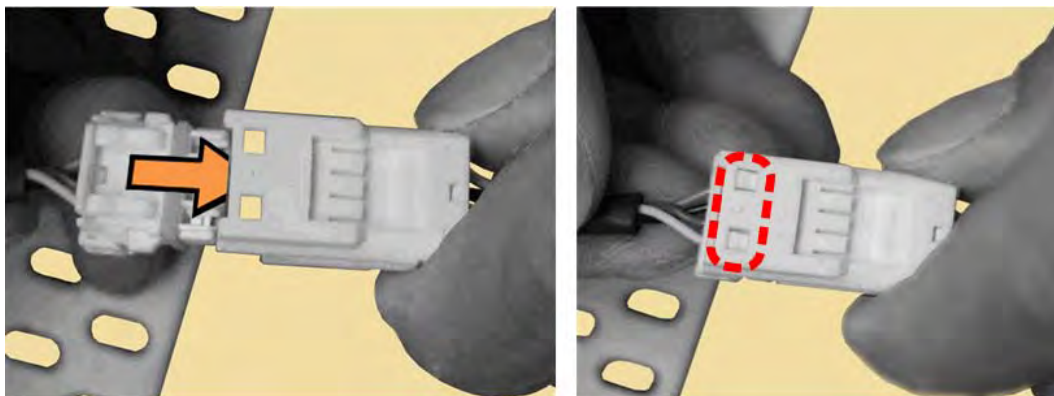
Figure C-7. Reconnect the Fan Power Supply

C.3   Clean the LPOD PS-1.5 Heat Sinks

To clean the LPOD PS-1.5 Heat Sinks, do these steps:

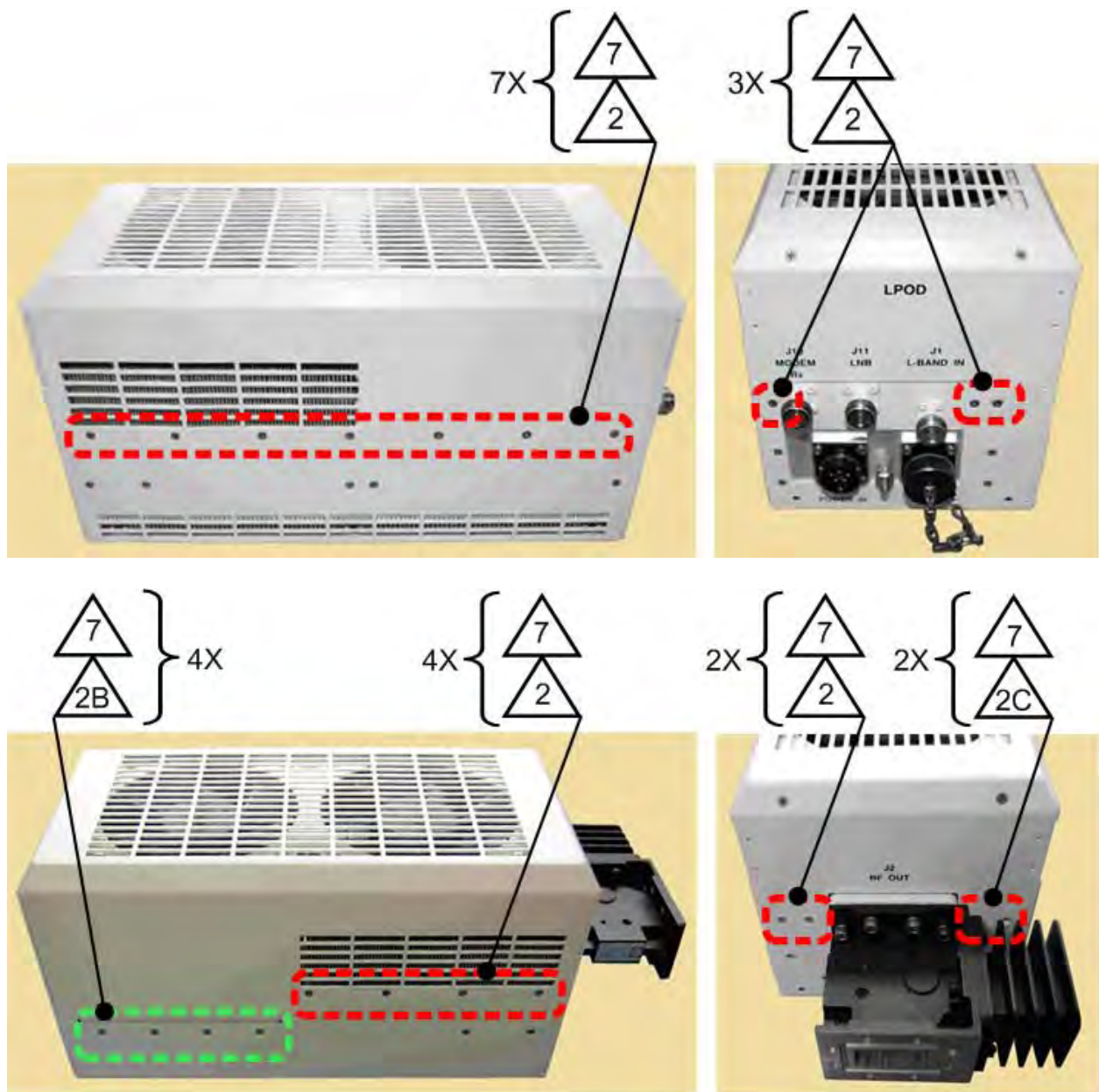| Step	Task
1	Disconnect power from the LPOD.
2	Remove the screws from all four sides of the LPOD as needed – see **Figure** C-8. ⊙ • **Make sure that you use an appropriate screwdriver, such as the one provided with the LPOD, to avoid damaging the screws.** • **The length of the four screws indicated in green are longer than those indicated elsewhere. Make sure that you re-install these longer screws at the same locations.** • **The two screws located behind the waveguide may be difficult to remove without first removing the waveguide from the chassis.**
3	Lift the fan shroud assembly far enough off the chassis to expose the heat sink and access the fan power supply connections – see **Figure** C-9.
4	Disconnect each fan power supply by carefully pulling the mated connector components straight apart – see **Figure** C-10. ⊙ **Do not twist the mated cable connection when disconnecting the cable assemblies.**
5	Visually inspect the the exposed LPOD heat sink, located on the top of the chassis, for any accumulated debris or blockage that may be obstructing airflow. Use compressed air to clear and clean the heat sink as needed – see **Figure** C-11. ⊙ **Make sure that you blow between the heat sink fins to remove any foreign object accumulation.**
6	Reconnect each fan power supply. First, align the male and female connector's tabs. Then, push the connectors together until the connection locks – see **Figure** C-12. ⊙ • **Do not twist the mated cable connections when reconnecting the fan power supplies.** • **The fan power supply cables are labeled Fan 1 and Fan 2. Make sure that you connect the chassis Fan 1 cable to the fan shroud Fan 1 cable, and the chassis Fan 2 cable to the fan shroud Fan 2 cable.**
7	Re-install the fan shroud onto the chassis – take care to keep the fan power supply cables clear of the fan and heat sink surfaces. Then, re-install all screws as described in **Step 2** – make sure that you re-install the four longer screws at their same locations. ⊙ **Torque the screws to 8 ±1 inch lbs.**
8	Reconnect the power source to the LPOD.

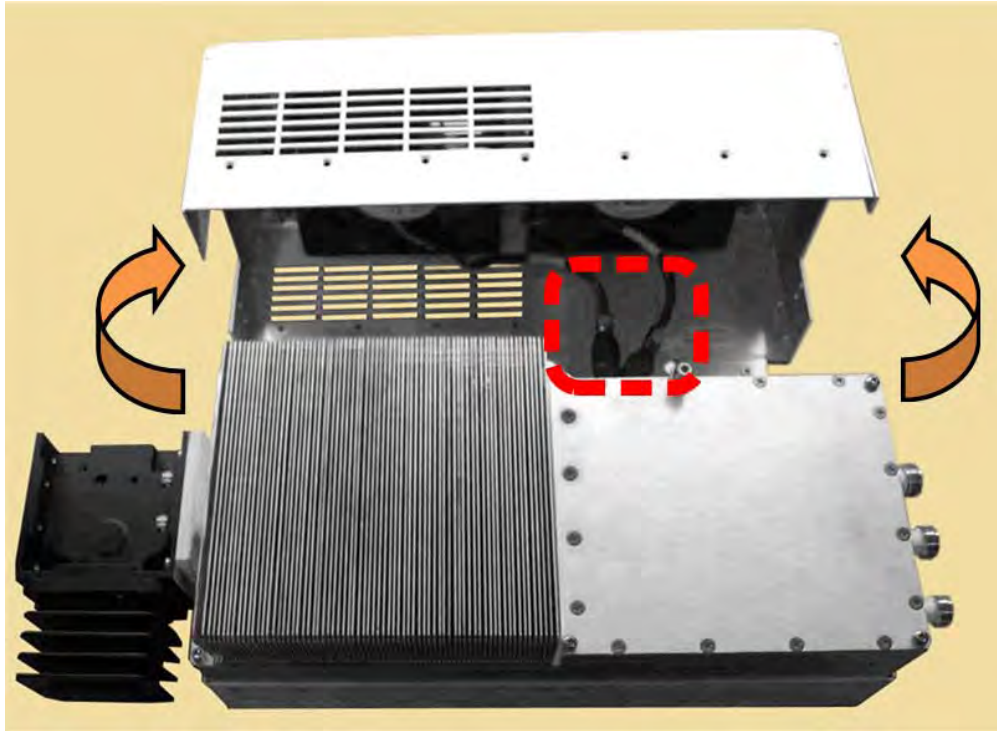**Figure C-8. LPOD PS-1.5 Shroud Screw Locations**

Figure C-9. Remove the Fan Shroud
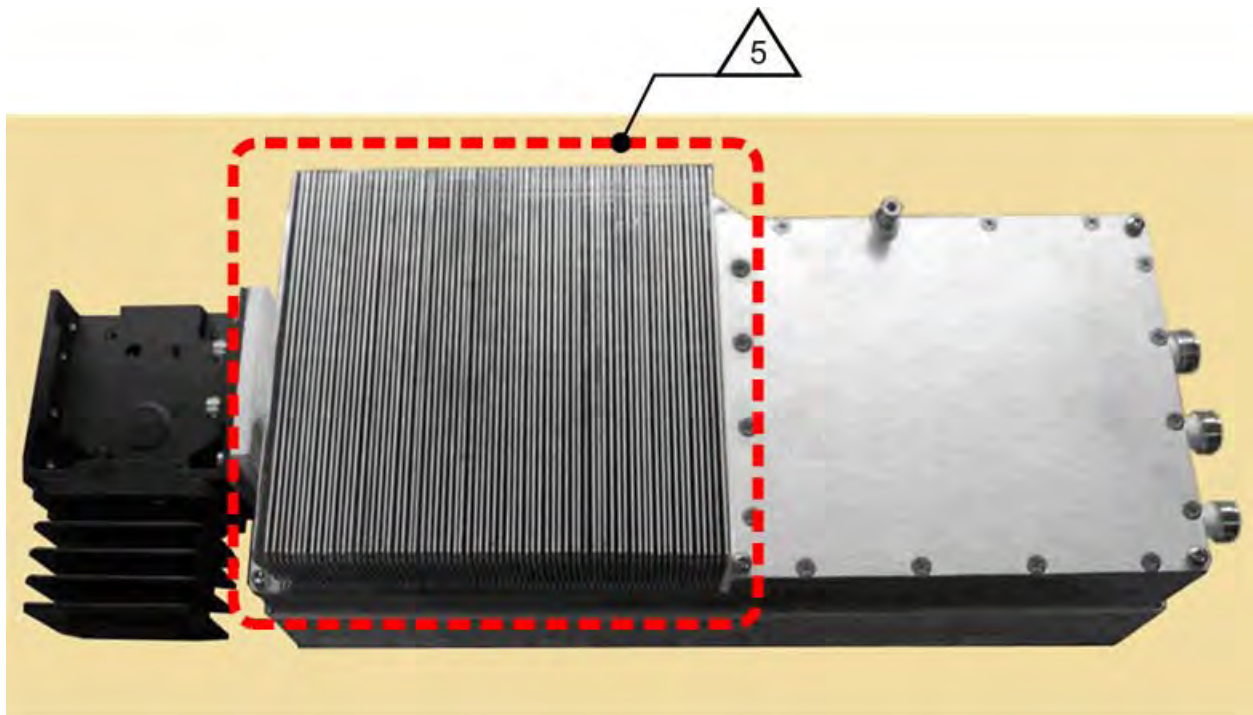
Figure C-10. Disconnect the Fan 1 / Fan 2 Power Supplies

Figure C-11. LPOD PS-1.5 Heat Sink Location

Figure C-12. Reconnect the Fan 1 / Fan 2 Power Supplies

C.4   Clean the LPOD PS-2 Heat Sinks

To clean the LPOD PS-2 Heat Sinks, do these steps:

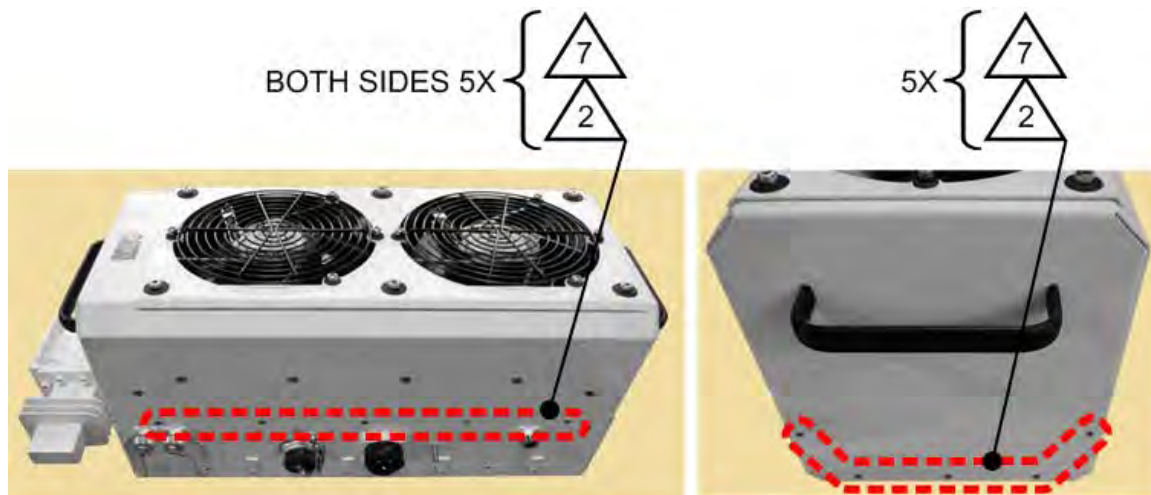| Step	Task
1	Disconnect the power source from the LPOD.
2	Remove the screws from the sides and end of the LPOD as needed – see **Figure C-13**. **Make sure that you use an appropriate screwdriver, such as the one provided with the LPOD, to avoid damaging the screws**
3	Lift the fan shroud assembly far enough off the chassis to expose the heat sink and access the fan power supply connections – see **Figure C-14**.
4	Disconnect each fan power supply by carefully pulling the mated connector components straight apart – see **Figure C-15**. **Do not twist the mated cable connection when disconnecting the cable assemblies.**
5	Visually inspect the the exposed LPOD heat sinks, located on the top of the chassis, for any accumulated debris or blockage that may be obstructing airflow. Use compressed air to clear and clean the heat sink as needed – see **Figure C-16**. **Make sure that you blow between the heat sink fins to remove any foreign object accumulation.**
6	Reconnect each fan power supply. First, align the male and female connector's tabs. Then, push the connectors together until the connection locks – see **Figure C-17**. • **Do not twist the mated cable connections when reconnecting the fan power supplies.** • **The fan power supply cables are labeled Fan 1 and Fan 2. Make sure that you connect the chassis Fan 1 cable to the fan shroud Fan 1 cable, and the chassis Fan 2 cable to the fan shroud Fan 2 cable.**
7	Re-install the fan shroud onto the chassis – take care to keep the fan power supply cables clear of the fan and heat sink surfaces. Then, re-install all screws as described in **Step 2**. **Torque the screws to 8 ±1 inch lbs.**
8	Reconnect the power source to the LPOD.

Figure C-13. LPOD PS-2 Shroud Screw Locations
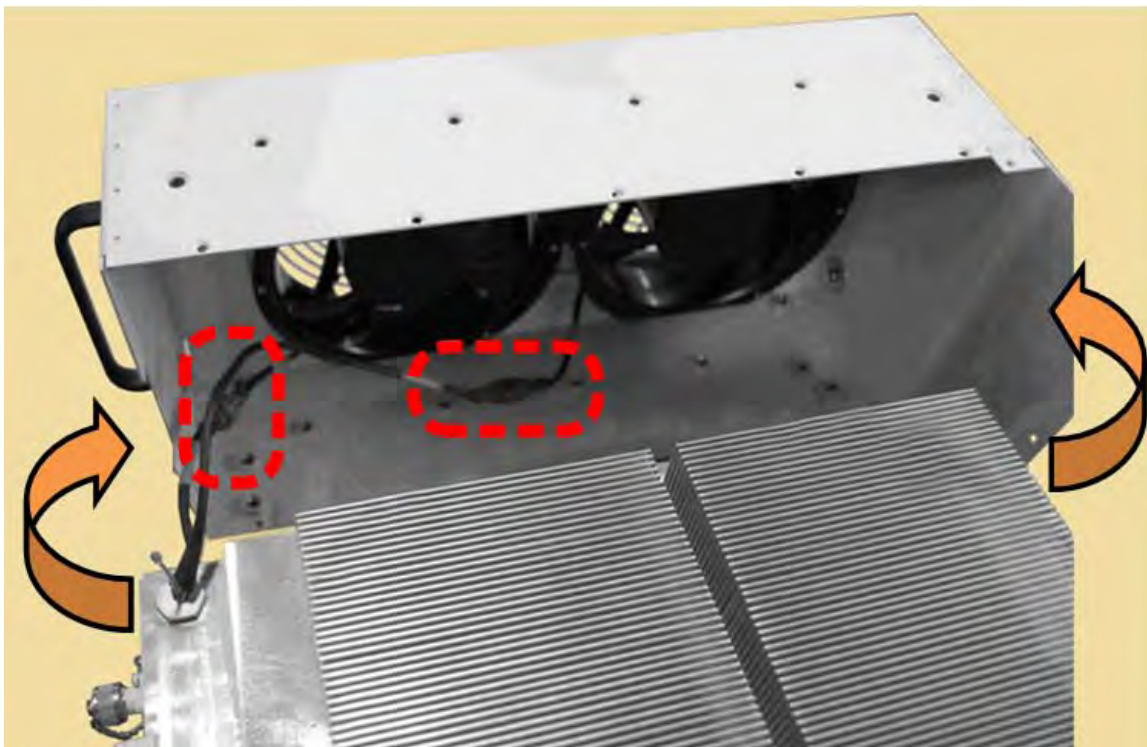

Figure C-14. Remove the Fan Shroud
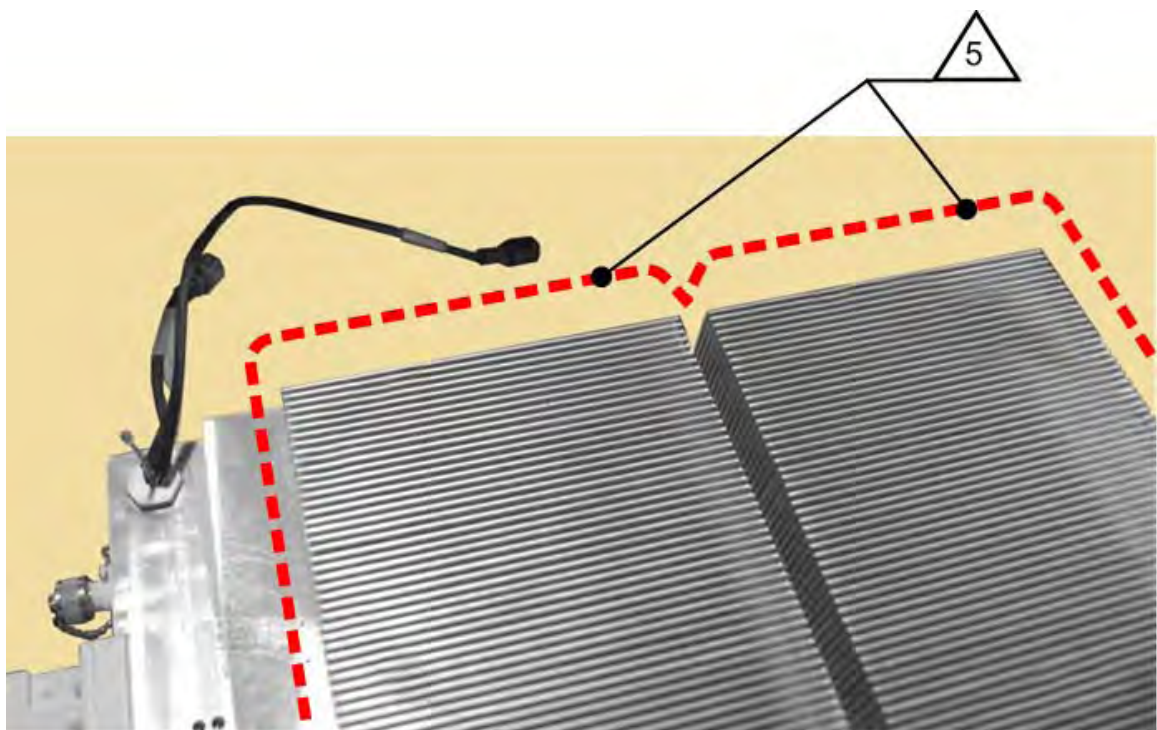
Figure C-15. Disconnect the Fan 1 / Fan 2 Power Supplies

Figure C-16. LPOD PS-2 Heat Sink Locations

Figure C-17. Reconnect the Fan1 / Fan 2 Power Supplies